Lost Crab and Cod Pot Recovery and Ghost Fishing In Chiniak Bay and Other Areas in the Waters Around Kodiak Island, Alaska.

By

Ivan Vining
Susie Byersdorfer
William Donaldson
Bradley Stevens
and
Gary Edwards

Regional Informational Report[1] No. 4K97-42

Alaska Department of Fish and Game
Commercial Fisheries Management and Development Division
211 Mission Road
Kodiak, Alaska 99615

August 1997

[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished division reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Commercial Fisheries Management and Development Division.

AUTHORS

Ivan Vining is a Westward Region Biometrican for the Alaska Department of Fish and Game, 211 Mission Road, Kodiak, Alaska, 99615.

Susie Byersdorfer is a Fishery Biologist I for the Department of Fish and Game, 211 Mission Road, Kodiak, Alaska, 99615.

William Donaldson is a Fishery Biologist III for the Alaska Department of Fish and Game, 211 Mission Road, Kodiak, Alaska, 99615.

Bradley Stevens is a Shellfish Research Biologist for the National Marine Fisheries Service, P.O. Box 1638, Kodiak, Alaska, 99615.

Gary Edwards is the skipper for the F/V Big Valley, P.O. Box 8101, Kodiak, Alaska, 99615.

SPONSORSHIP

This project was funded in part by the U.S. Army Corps of Engineers, Alaska District.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (Cont.)

LIST OF APPENDICES

LIST OF APPENDICES (Cont.)

INTRODUCTION

Lost and derelict fishing gear has been a concern for many years (Breen 1990; Sheldon and Dow 1975; Smolowitz 1978a). The main concerns surrounding lost or derelict fishing gear have been centered around three basic categories: aesthetics, entanglement and ghost fishing. The aesthetics concern is mostly due to washed up fishing gear on public/ recreation beaches. Aesthetics might be classified as a social or economic problem, whereas entanglement and ghost fishing are environmental problems. Entanglements by lost or derelict fishing gear have included marine mammals, birds and reptiles (Laist 1996), non-targeted fish and shellfish (Carr et. al. 1990) and boats (Kirkley and McConnel 1997). The term "ghost fishing" as used in this paper was defined by Smolwitz (1978a): "the ability of fishing gear to continue fishing after all control of that gear is lost by the fisherman".

The impact of ghost fishing has been a growing concern in many fisheries (Breen 1987, 1990). Some studies have tried to quantify the amount of ghost fishing, with varying results (Breen 1987; Guillory 1993; High and Worlund 1979; Muir et al 1984; Parish and Kazama 1992; Sheldon and Dow 1975; Smolowitz 1978b). For example, studies carried out by Parish and Kazama (1992) found ghost fishing to be a minor concern, because Hawaiian spiny lobsters, *Panulirus marginatus*, could go in and out of the pots easily. Conversely, Sheldon and Dow (1975) considered ghost fishing to be a significant concern. In a study on the American lobster, *Homarus americanus*, the authors estimated that approximately one third of all lobsters entering lost pots would perish. Other studies have identified ghost fishing as a concern or possible problem, and identified possible solutions to reduce the loss of resource (Carr and Harris 1997; High 1976, High and Worlund 1979; Kruse and Kimker 1993; Pecci et al. 1978; Smolowitz 1978b; Stevens et al. 1993).

Lost fishing gear has been addressed by several studies in Alaskan waters. The emphasis of some of these studies has centered around lost fishing gear and its possible entanglement of marine mammals (Fowler 1986; Johnson 1990; Johnson and Merrell 1988). Studies on the impact of ghost fishing by lost crab pots in Alaska waters include High and Worlund 1979, Kimker 1994, Kruse and Kimker 1993, and Stevens et al. 1993.

In this report we examine ghost fishing by lost crab or cod pots in specific areas off the northeast shore of Kodiak Island, Alaska (Figure 1). The location of 190 lost pots in Chiniak Bay were identified in April 1994, while performing sidescan sonar studies on the podding behavior of crab (Appendix A). With this information we decided to estimate the extent of ghost fishing by this known quantity of lost fishing gear and compare it to other recovered lost pots.

This report uses data collected from 3 different surveys, which were carried out by the Alaska Department of Fish and Game (ADF&G) and the National Marine Fisheries Service (NMFS) staffs during 1995 and 1996:

1) A pilot study was conducted in 1995 within Chiniak Bay, in an attempt to recover lost pots and analyze the ghost fishing of the lost gear.

2) A directed study was conducted in 1996 within Chiniak Bay, to further recover known lost pots and analyze the effects of ghost fishing.
3) An undirected study was conducted in 1996 within Kalsin, Chiniak, Womans and Ugak Bays, to recover pots in areas known to have been heavily fished during past crab fisheries, but without knowing specific pot locations.

METHODS

Pilot Study, April 1995

The pots identified from the sidescan sonar project (Appendix A) were plotted on a map (Figure 1), then enumerated (Appendix B. 1.). A random sample of 23 pots was chosen from the 177 enumerated single pots. The pots identified from the sidescan sonar as being in a group (those which seemed to have line between them) were not used in the random selection process, due to concern on the part of the skipper of the Resolution that the many lines from the group might get caught in the propeller, during pot retrieval.

A special grappling device had been constructed for the project (Figure 2 and 3), which was designed to hook the floating line of the pots or perhaps the pot frame itself. This device was connected to a steel cable, which was run through a winch on the ships main boom. The approximate locations of the pots were known, however the placement of the grappling device on the bottom was imprecise. The basic procedure for grapple deployment and retrieval during the pilot study was as followed:

1. The grappling device was lowered into the water, when the ship was several hundred meters (.1 nm) from the targeted pot.
2. Once the grappling device was on the bottom of the bay, the ship would tow past the pot at less than 5.6 km/hr (3 knots), over the area where the pot was supposed to be located.
3. If the grappling device did not hook any lines or the pot, then the Resolution would continue to circle the location.
4. Step 3 was repeated until the pot or it's lines were hooked, or it was decided the pot had moved since the sidescan sonar project.
5. The pot was brought onboard using the ships crane.
6. Information was then collected about the pot and its contents, and recorded on data forms designed for the survey (Appendix C).
7. Steps 1-6 were repeated at the next location.

This procedure was used throughout most of the study, with gear modifications and replacement being made twice. The grappling device was replaced once by a trawl net, to verify the location of certain pots.

Basic descriptive statistics were used to characterize the pots and their contents. The number of pots by category (rectangular, pyramid, or conical) were counted, as well as the proportion with bait jars, tears, and bio-degradable mesh. The mean number and size of crab per pot was calculated, for the various species of crab found in the recovered pots. Carapace width (CW) were measured to the nearest 1 mm with veriner calipers across the widest part of the carapace, excluding spines. Records on the number of individuals and their size for other commercially important species were kept, as well as counts for all species.

Directed Study June 17 - July 18, 1996

The procedures employed in pot recovery during the 1996 directed study were similar to those used in the 1995 pilot study, but with some modifications. Using the same procedure as was employed in 1995, all single pots were mapped, enumerated (Appendix B.1.) and 25 pots were randomly selected as the initial single pots to be retrieved. There were only 25 pots selected initially because we were concerned there might be low pot recovery and wanted to insure randomness was maintained. Additional random samples, each of size 10, were drawn from the remaining pots, to be retrieved as time permitted. Instead of avoiding the two groups which had pots connected, an attempt was made to retrieve them first. This was done to establish a useable technique, by first targeting on these larger groups

The original pot grapple beam device used in the directed pot survey is shown in figure 4. The device consisted of a 5.1 cm (2 in) by 6.4 m (21 ft) steel pipe beam capped at both ends. The pipe was attached to a 5.2 m (17 ft) bridle made out of 1.9 cm (3/4 in) synthetic line. The bridle was attached by a metal ring to a 1.1 cm (7/16 in) single wire warp cable pulled by a 5.4 metric ton gearmatic (hydraulic) winch. A large buoy with 183 m (600 ft) of tag line was attached to the pipe beam, to retrieve the device if the tow line was broken. Six grapples were dragged from the beam (Figures 4 - 6).

The grapple design was modified twice and the entire device layout was modified once. On June 25, 1996 a second set of arms were welded to the grapples on the backside of existing arms. (Figure 7). The grapples were dragged across the bottom this way until July 8, 1996 when a 7.6 cm (3 in) piece of roundbar was welded to the ends of the existing tines to prevent snagged line or pot frames from slipping off while hauling back (Figure 8). On June 29, 1996 the gear was adjusted by adding 21.4 m (70 ft) of 1.3 cm (1/2 in) chain with quick release links 3 m (9.6 ft) apart. The chain was attached between the bridle of the beam and wire warp. Three additional grapples were attached to the chain and a 13.5 kg (30 lb) weight was added to the bridle ring (Figure 9). This particular gear was used only two days because it took too much time to set and retrieve and there was no noticeable improvement in catches. The design modification on June 29 was used only two days and then changed back, because the modification made the gear difficult to deploy and retrieve, and was less efficient.

Two different methods of pulling the grapple beam device were employed. The first method was as follows:

1. The device was lowered into the water, with both vessel engines engaged at dead ahead slow, approximately 4.6 km/hr (2.5 knots), with enough cable let out to maintain a 2:1 scope.

2. The target site was usually a group of pots within close proximity to one another, with the designated pot within the group.
3. Transects were run in the direction which would cover the greatest target area.
4. Parallel transects were then run at 1/2 speed by engaging only one engine, at approximately 2.8 km/hr (1.5 knots).
5. The wire warp connected to the beam was watched (from the winch control station on deck and the wheelhouse) constantly for signs of hang, shown by vibration or strain.
6. During haulback, the vessel was kept going ahead slow to keep the gear clear of the stern.
7. Once the beam surfaced, the vessel was put in neutral and drifted.
8. The gear and pot or snag were retrieved using the ships crane.
9. The pot was given a number as the most likely pot recovered as numerated by the sidescan sonar locations (Appendix B.1.).
10. Information was then collected about the pot and its contents and recorded on forms designed for the survey (Appendix C).
11. A new target group was chosen and steps 1-10 repeated.

The technique for deploying and retrieving gear employed by the second method was the same as in the first method but instead of running parallel transects, the vessel was set in a 10° turn with the opposed engine engaged.

The tag line and buoy were usually left to trail astern during daily operations and was brought aboard at the end of the day. All retrieved pots had their webbing cut and disposed of at a location, designated by the U.S. Army Corps of Engineers, at the end of a daily operation.
Basic descriptive statistics were used to characterize the pots and their contents. The number of pots by category (rectangular, pyramid, or conical) were counted, as well as the proportion with bait jars, tears, and bio-degradable mesh. The mean and median number and size of crab per pot was calculated, for the various species of crab found in the recovered pots. Records on the number of individuals and their size for other commercially important species were kept, as well as counts for all species.

Undirected Study August 19-31 and October 5-21, 1996

The undirected study conducted pot retrieval operations first from August 19-31, 1996, and then from October 5-21, 1996. The break between the two sampling periods, September 1-October 4, 1996, was due to the charter boat commercial fishing.

The gear design was changed during the undirected study, because the original pot grapple was damaged beyond repair. A new simpler pot grappling device (Figure 10 and 11) was utilized. The new design worked well in the shallower bay waters and so no further changes to the grappling gear were made, except the number of grappling hooks varied from 2-6 and the length of the shanks on the grapplers went from 61 cm (24 in) to 91 cm (36 in).

The method employed for pot retrieval during the undirected study was similar to the methods used in the directed study, despite the change in gear and the lack of pot location information:

1. The vessel towed the wire cable with 30.5 m (100 ft) of 1.9 cm (3/8 in) chain to which 2-6 grapples (Figure 10 and 11) were attached.
2. The vessel was towing at 2.8 km/hr (1.5 knots) in a constant 10° turn until the track line varied or a snag was felt.
3. During haulback, the vessel was kept going ahead slow to keep the line clear of the stern.
4. Once the grapplers surfaced, the vessel was put in neutral and drifted.
5. The grapples and pot or snag were retrieved using the ships crane.
6. Recovered pots were given a number, in the order retrieved, starting with 2001.
7. Information was then collected about the pot and its contents and recorded on forms designed for the survey (Appendix C).
8. Steps 1-7 were then repeated.

Basic descriptive statistics were used to characterize the pots and their contents. The number of pots by category (rectangular, pyramid, or conical) were counted, as well as the proportion with bait jars, tears, and bio-degradable mesh. The mean and median number and size of crab per pot was calculated, for the various species of crab found in the recovered pots. Records on the number of individuals and their size for other commercially important species were kept, as well as counts for all species.

RESULTS

A total of 147 pots of varying age, size and type were retrieved during the three studies (Appendix D and E). Some of the pots were heavily encrusted with biota, while others were fairly clear of organisms (Figures 12 and 13). Also, some of the pots were still in a useable condition, and others were completely collapsed (Figure 14). A total of 227 Tanner crab, *Chionoecetes bairdi*, of varying sex and size was recovered from this lost gear (Appendix F). The following is a summary of the results from these studies.

Pilot Study, 1995

The R/V Resolution retrieved 7 pots in 7 days (Table 1 and Appendix D. 1.), with pot condition ranging from very poor to good. Recovered pots included 5 conical pots and 2 rectangular pots (Appendix E). All of the pots were considered to be at least 1 year old yet, four of them had intact biodegradable twine. There were 3 pots that seemed to have no biodegradable twine, however two of these pots had holes which may have been caused by twine degrading. Three of the pots had holes in the webbing large enough for a crab to escape, while four of the pots had no holes.

Several organisms, including Tanner crab were present in the pots (Table 2). Tanner crab was the most common species found in the pots (28 including empty carapaces) with sun star, *Solaster* sp, being the second most common organism (12). All organisms recovered in the lost pots occurred in only one pot (e.g. though 12 sun stars were recovered, they were all located in pot # 38), except Tanner crab and Pacific octopus, *Octopus dofleini,* which each occurred in 3 pots.

There was an average of 4.00 Tanner crab per pot, however one pot contained 22 Tanner crab (Table 3); excluding this pot, the average number of Tanner crab per pot was 0.86. The average carapace width (CW) for the Tanner crab recovered from the lost pots was 137.2 mm (Figure 15, and Appendix F. 1.). Approximately 8.0% of the Tanner crab were female (96.0 mm average CW) and 92.0% male (140.7 mm average CW). The 22 Tanner crab caught in one pot were all males. Several of the pots that contained Tanner crab or empty carapaces also contained a giant Pacific octopus (Table 3).

Directed Study June 17, 1996- July 18, 1996

Forty three pots were recovered out of the 190 pots identified by the sidescan sonar study (Table 4, and Figure 16), including 1 cod pot, 8 conical pots, 8 pyramid pots, and 26 rectangular pots (Appendix D. 2. and E). Pots located in the southeast section of the sidescanned area could not be retrieved due to underwater cables and rocks in the area. Pot condition ranged from very poor to excellent. There were no pots found with intact biodegradable twine. Twenty eight pots were identified as having no biodegradable twine, however 18 of these pots had holes which might have been the result of twine degradation. A total of 34 (79.1%) of the 43 recovered pots had torn webbing or degraded twine, which other means possible for a crab to escape the pot other than the pot tunnels.

The pots recovered during the directed study contained similar organisms as were found in the pilot study (Table 5). The hairy triton, *Fusitriton oregonensis*, was the most numerous organism with 160 found in the lost pots, while sunflower sea stars, *Pycnopodia helianthoides*, occurred most often (22 out of 43 or 51.2% occurrence). Invertebrates made up the vast majority of organisms in the lost pots, along with 6 species of fish (Table 5 and Appendix F.5.).

Tanner crab was the third most abundant (67 including carapaces) organism found in the recovered pots. Mean CPUE was 1.56 Tanner crab per pot, but if the maximum and minimum values are removed the average drops to 1.22 per pot. Sixteen (37.2%) of the pots recovered during the directed study contained Tanner crab, with an average CW of 85.1 mm. Male crabs comprised 41.3% with an average CW of 86.8 mm, and 58.7% were female with an average CW of 84.0 mm (Figure 17 and Appendix F. 2.).

There were 16 pots containing Tanner crab, and 3 of these 16 pots also contained octopus (Table 6). However, when an octopus was located in a pot, there was usually Tanner crab, with 3 of the 5 (60%) occurrences of octopus being in association with Tanner crab.

Undirected Study, 1996

There were 48 pots recovered in the first period (August 19-31, 1996) and 41 (October 5-21, 1996) during the second period, for a total of 89 pots. These pots were given numbers starting with 2001 and ending with 2089. Eight more pots (numbered 1001-1008 in the order recovered) were retrieved during the directed study, but were not previously identified from the sidescan sonar (Appendix D. 3.), so were classified as pots retrieved during undirected operations. Pots 1001, 1007 and 1008 were recovered from the sidescan sonar area, but were estimated to be less than a year old and probably subsistence pots (since commercial fishing had been closed in this area for over two years). Pots 1002-1006 were retrieved outside the sidescanned area, near Puffin Island, close to the town of Kodiak. The total number of pots classified as recovered in the undirected study (including the 8 pots recovered during the directed study time period) was 97 (Table 7, Figure 18, Appendix D. 3.). Pot conditions ranged from very poor to good. There were a total of 1 cod pot , 10 conical pots, 27 pyramid pots, 45 rectangular pots, 9 round pots, 1 shrimp pot, 2 subsistence pots and 1 55-gallon drum (home made pot) retrieved (Appendix D. 3. and Appendix E).

Most of the pots either had degraded biodegradable twine or holes in them. There were only 4 pots found with intact biodegradable twine, and 3 of the 4 were estimated to be at least 3 years old. There were 73 pots without detectable biodegradable twine, however 48 of these pots had holes which might have been the result of twine degrading. There were a total of 70 pots (72.2%) that had either degraded twine and/or holes large enough for a crab to escape (Table 7, Appendix D. 3.).

The pots recovered in the undirected study tended to have few organisms in them and 40 of the 97 (41.2%) pots had no organisms within them. Tanner crab was the most abundant organism (132 individuals or 1.36 Tanner crab per pot) from the undirected study; however this was primarily due to one pot (# 1001, Figure 19), which contained 125 Tanner crab (118 live and 7 carapaces). Excluding this pot, only 7 Tanner crab were recovered from the remaining 96 pots or 0.07 Tanner crab per pot. Furthermore, only 5 pots (5.2%) of the 96 remaining pots, contained Tanner crab. The average CW for all Tanner crab recovered in the undirected study was 133.1 mm, but was 73.7 mm if pot # 1001 is excluded. The average CW for Tanner crab in pot # 1001 was 136.7 mm. The approximate sex percentages were 97.5% male (average 134.7 mm CW) and 2.5% female (average 68.7 mm CW) but becomes 80.0% male (average CW of 77.5) and 20.0% female (average CW of 68.0 mm) without pot # 1001 (Figure 20 and Appendix F. 3.).

The sunflower sea star was the organism which occurred most often, in 39 pots (40.2%) and also occurred in second greatest number (98, 1.01 per pot). Invertebrates made up the vast majority of organisms in the lost pots, however there were 4-6 species of fish caught as well (Table 8).

As in the directed study of 1996, during the undirected study we did not find a strong correlation between the presence of Tanner crab and octopus in pots, that was found during the pilot study (Table 9). Of the 5 pots containing Tanner crab, only one (20%) had an octopus in it. Octopus were fairly common, occurring in 6 pots, including pot # 1001.

Four red king crab, *Paralithodes camtschaticus*, were found during the undirected study (none were found in the pilot or directed study). All the red king crab were male and 3 of the 4 were of legal size. The three legal red king crab were within the same pot (Tables 8 and 9, Figure 21, Appendix F. 4.).

DISCUSSION

The pilot study of 1995 raised many questions about lost pots in the Kodiak area. The relatively high occurrence of Tanner crab in pots was one of the most distressing. The implication of an average of 4 crab per pot, in areas where thousands of pots had been lost (Laist 1996) was staggering. Another concern was the high incidence of biodegradable twine still intact after a year in the water and the number of pots without biodegradable twine. Since 1977, the state of Alaska has required all crab pots to contain an 18 inch (45.7 cm) segment of biodegradable twine that degrades within 90 days (Alaska Statues, 1996). Once again, the implication of many pots being lost, continuing to catch and hold crab, since the twine had not degraded or wasn't present, was reason for further concern.

The directed and undirected studies seemed to indicate a less dramatic problem with lost pots. This especially becomes apparent when the data of the directed and undirected studies is combined (Tables 10 and 11). From this combination, despite the variation in different pots, 73.6% of the pots had a hole large enough for crab to escape, with some holes likely due to the degrading of the biodegradable twine. All holes were thought to have been made prior to the pot being retrieved (i.e. none of the holes were thought to be the result of the grappling device tearing the net), with many holes having organisms growing on the ends of the twine around the holes. Also, several pots (42, 30.0%) had more than one hole. We further found Tanner crab in only 15.0% of the lost crab pots and in those pots with Tanner crab, 52.4% had holes (not including tunnel openings) large enough for crab to escape. This implies that only 7.1% of all the pots, contained crab which had no escape route other than the tunnel openings. The average catch of Tanner crab per pot was 1.42, but only 0.53 Tanner crab per pot when not including the highest catch (much smaller than 4 crab per pot in both cases). We also discovered that red king crab were rarely found in pots, and in the one that had 3 legal males the pot contained a recently dead Pacific cod which probably acted as bait.

Pot #1001 contained 118 live Tanner crab, 7 Tanner crab carapaces and one large octopus and was thought to be a recently lost, less than 1 year old, subsistence pot (Tables 8 and 9, Appendix F. 3). This pot had no torn webbing or other large holes, except the tunnel opening. Most of the crab in this pot were in poor condition with many having limb loss and/or black mat disease. Empty crab carapaces suggested that the octopus had consumed some of the crab. It is unlikely that many of the crab would have survived more than a few more months in this pot.

There are several explanations presented in the literature, which might explain the low numbers of crab observed in the lost pots. Breen (1987) found varying numbers of crab in pots at different times of the year and concluded that a study must be conducted all year round to get the best estimate of crab entering pots. Other researchers (Hancock 1974; High and Worlund 1979), have implicated that dead or dying crustaceans will repel other crustaceans of the same species. Though not explaining the high number of empty pots, other studies have found high predation by octopus, and possibly cleaning out pots (Breen 1987; High 1976).

Most of the Tanner crab were caught in or near the area where the sidescan sonar study had been conducted (Figures 22 and 23). This area was fished during the Tanner crab fisheries because of its high concentration of Tanner crab. However, due to the lack of sidescan sonar data for other areas, we do not know the density of lost pots in this area compared to the other areas where lost pots were retrieved.

The relative trend of Tanner crab caught in the 1996 trawl survey, performed by ADF&G (Urban in press), was similar to the trend encountered during the 1996 directed and undirected studies (Figure 24). During the 1996 trawl survey, the density for Tanner crab was about 486 crab per nmi trawled in the Chiniak area, 28 crab per nmi trawled in the Kalsin Bay area, and 22 crab per nmi trawled in Middle Bay area, for an approximate 272 Tanner crab per nmi trawled CPUE in the directed and undirected study areas combined. During the 1996 directed and undirected studies for the three areas, we estimated 2.70 Tanner crab per pot for the Chiniak area (not including the Puffin Island pots, pots # 1002-1006 and # 2001-2005) or 1.00 Tanner crab per pot for the Chiniak area not including pot # 1001; 0.04 Tanner crab per pot for Kalsin Bay and 0.00 Tanner crab per pot for Middle Bay. For both the 1996 trawl survey and 1996 directed and undirected pot retrieval studies, the Chiniak area (with or without pot # 1001) had the highest density of Tanner crab, with Kalsin Bay second and Middle Bay last. Chiniak Bay is also known to be a crab aggregation site (Stevens et al. 1994).

CONCLUSIONS

The directed and undirected studies indicated there weren't many crab continuing to be caught in lost and derelict pots (Table 11 and 12, Figures 22 and 23, Appendix F), contrary to the pilot study of 1995. There was an indication that recently lost pots (< 3 years old) catch Tanner crab at a higher rate than pots lost for longer period (> 2 years old). There were more smaller sized crab (< 120 mm) found in the older pots, as well. Small crab may be entering the pots for shelter, which may be the reason sunflower sun stars and the occasional octopus are entering these pots as well.

From our study, we believe there is no clear explanation why few crab per pot were found within the older (> 3 years old) lost pots. Further field work and/or laboratory experiments are needed to investigate the reasons for the low occurrence and number of crab in the recovered pots.

LITERATURE CITED

Alaska Statues, 1996. Alaska Statues volume 5, Alaska Legislature Council. Michie, Law Publishers, Charlottesville, Virginia.

Breen, P.A. 1987. Mortality of Dungeness crabs caused by lost traps in the Fraser River Estuary, Bristish Columbia. North American Journal of Fisheries Management. 7:429-435.

Breen, P.A. 1990. A review of ghost fishing by traps and gillnets. In: R.S. Shomura and M.L. Godfrey [eds.]. Proceedings of the Second International Conference on Marine Debris, 2-7 April 1989, Honolulu, Hawaii. U.S. Department of Commerce, NOAA Technical Memo. NMFS-SWF-SC-154, pp. 571-599.

Carr, H.A. and J. Harris. 1997. Ghost-fishing gear: Have fishing practices during the past few years reduced the impact. In: J.M Coe and D.B. Rogers. Marine Debris: Sources, Impacts and Solutions. Springer, New York, pp. 171-186.

Carr, H.A., E.H. Amaral, A.W. Hulbert, and R. Cooper. 1990. Underwater survey of simulated lost demersal and lost commercial gill nets off New England. In: R.S. Shomura and M.L. Godfrey [eds.]. Proceedings of the Second International Conference on Marine Debris, 2-7 April 1989, Honolulu, Hawaii. U.S. Department of Commerce, NOAA Technical Memo. NMFS-SWF-SC-154, pp. 438-447.

Fowler, C.W. and T.R. Merrel. 1986. Victims of plastic technology. Alaska Fish & Game 2: 34-37

Guillory, V. 1993. Ghost fishing by blue crab traps. North American Journal of Fisheries Management 13:459-466.

Hancock, D.A. 1974. Attraction and avoidance in marine invertebrates-their possible role in developing an artifical bait. J. Cons. Int. Explor. Mer, 35(3): 328-331.

High, W.L. 1976. Escape of Dungeness crabs from pots. Marine Fisheries Reveiw. 38(4):19-23.

High, W.L., and D.D. Worlund. 1979. Escape of king crab, *Paralithodes camtschatica*, from derelict pots. NOAA Techincal Report NMFS-SSRF-734. 11 pp.

Johnson, S.W. 1990. Distribution, abundance and source of entanglement debris and other plastics on Alaskan beaches, 1982-88. In: R.S. Shomura and M.L. Godfrey [eds.]. Proceedings of the Second International Conference on Marine Debris, 2-7 April 1989, Honolulu, Hawaii. U.S. Department of Commerce, NOAA Technical Memo. NMFS-SWF-SC-154, pp. 331-348.

Johnson, S.W. and T.R. Merrell. 1988. Entanglement debris on Alaskan beaches, 1986. NOAA Technical Memorandum NMFS F/NWC-126. 25 pp.

Kirkley, J. and K.E. McConnell. 1997. Marine debris: benefits, costs and choices. In: J.M Coe and D.B. Rogers. Marine Debris: Sources, Impacts and Solutions. Springer, New York, pp. 171-186.

Kimker, A. 1994. Tanner crab survival in closed pots. Alaska Fisheries Research Bulletin. 1(2): 179-183.

Kruse, G.H. and A. Kimker. 1993. Degradable escape mechanisms for pot gear: A summary report to the Alaska Board of Fisheries. Regional Information Report No. 5J93-01, 23 pp.

Laist, D.W. 1996. Marine debris entanglement and ghost fishing: A cryptic and significant type of bycatch. In: Solving Bycatch: Considerations for Today and Tomorrow. Alaska Sea Grant College Program report; 96-03: pp. 33-39.

Muir, W.D., J.T. Durkin, T.C. Coley, and G.T. McCabe Jr. 1984. Escape of captured Dungeness crabs from commercial crab pots in the Columbia River estuary. . North American Journal of Fisheries Management 4:552-555.

Parish, F.A. and T.K. Kazama. 1992. Evaluation of ghost fishing in the Hawaiian lobster fishery. Fisheries Bulletin 90:720-725.

Pecci, K.J., R.A. Cooper, C.D. Newell, R.A. Clifford and R.J. Smolowitz. 1978. Ghost fishing of vented and unvented lobster, *Homarus americanus*, traps. Marine Fisheries Review 40(5-6):9-43.

Sheldon, W.W. and R.L. Dow. 1975. Trap contributions to losses in the American lobster fishery. Fisheries Bulletin 73:449-451.

Smolowitz. R.J. 1978a. Trap design and ghost fishing: An overview. Marine Fisheries Review 40(5-6): 2-8.

Smolowitz. R.J. 1978b. Trap design and ghost fishing: Discussion. Marine Fisheries Review 40(5-6): 59-67.

Stevens, B.G., J.A. Haaga, and W.E. Donaldson. 1993. Underwater observations on behavior of king crabs escaping from crab pots. AFSC Processed Report 93-06. Alaska Fisheries Science Center, NMFS, Seattle, WA, 14 pp.

LITERATURE CITED (Cont.)

Stevens, B.G., J.A. Haaga, and W.E. Donaldson. 1994. Aggregative mating of Tanner crabs Chionoecetes bairdi. Canadian Journal of Fisheries and Aquatic Sciences 51: 1273-1280.

Urban, D. In press. The 1996 Kodiak crab trawl survey.

Table 1. Pot types and biodegradeable twine information for pots recovered during the pilot study 1995.

Pot Type	Biodegradeable Twine: Not Recorded	Degraded	Intact	None	Number of Each Pot Type
conical	0	0	2	3	5
rectangular	0	0	2	0	2
Total	0	0	4	3	7

Table 2. A summary of the organisms within the 7 retrieved pots from the pilot study in 1995.

Common Name	Species Name	Total Caught	Average Caught	Max. # in a Pot	Average w/o Max & Min	Total # Pots w/ Species	Percent Pots w/ Species
Tanner crab All	*Chionoecetes bairdi*	28	4.00	22	1.20	3	42.9%
Tanner crab Live	*Chionoecetes bairdi*	25	3.57	22	0.60	3	42.9%
Tanner crab carapace	*Chionoecetes bairdi*	3	0.43	3	0.00	1	14.3%
sun star	*Solaster* (no species recorded)	12	1.71	12	0.00	1	14.3%
giant Pacific octopus	*Octopus dofleini*	3	0.43	1	0.40	3	42.9%
sunflower sea star	*Pycnopodia helianthoides*	2	0.29	2	0.00	1	14.3%
Pacific cod	*Gadus macrocephalus*	1	0.14	1	0.00	1	14.3%
rockfish	*Sebastes* (no species recorded)	1	0.14	1	0.00	1	14.3%
green sea urchin	*Strongylocentrotus droebachiensis*	1	0.14	1	0.00	1	14.3%

Table 3. The number of Tanner crab and octopi found in recovered pots, during the pilot study, 1995.

Pot #	Pot Type	Minimum Age (years)	Torn Web	Depth (m)	Tanner Crab Live	Tanner Crab Carapace	Tanner Crab All	Giant Pacific Octopus
38	Rectangular	2	N	NR	0	0	0	1
112	Conical	1	N	144	22	0	22	1
143	Conical	2	Y	NR	1	3	4	1
145	Rectangular	2	N	NR	2	0	2	0

NR stands for Not Recorded. This indicates that the information did not get recorded on the data form at the time the pot was retrieved.

Table 4. Pot types and biodegradeable twine information for pots recovered during the directed study 1996.

Pot Type	Biodegradeable Twine: Not Recorded	Degraded	Intact	None	Number of Each Pot Type
cod	0	1	0	0	1
conical	0	2	0	6	8
pyramid	0	2	0	6	8
rectangular	1	9	0	16	26
Total	1	14	0	28	43

Table 5. A summary of the organisms within the 43 retrieved pots from the directed study in 1996.

Common Name	Species Name	Total Caught	Average Caught	Max. # in a Pot	Average w/o Max & Min	Total # Pots w/ Species	Percent Pots w/ Species
hairy triton	*Fusitriton oregonensis*	160	3.72	50	2.68	14	32.6%
sunflower sea star	*Pycnopodia helianthoides*	89	2.07	13	1.85	22	51.2%
Tanner crab All	*Chionoecetes bairdi*	67	1.56	17	1.22	16	37.2%
Tanner crab Live	*Chionoecetes bairdi*	46	1.07	9	0.90	12	27.9%
Tanner crab carapace	*Chionoecetes bairdi*	21	0.49	8	0.32	8	18.6%
anemone (white)	*Metridium senile*	54	1.26	50	0.10	2	4.7%
tube worms	*Crucigera* (no species recorded)	50	1.16	50	0.00	1	2.3%
green sea urchin	*Strongylocentrotus droebachiensis*	20	0.47	6	0.34	9	20.9%
decorator crab	*Oregonia gracilis*	12	0.28	2	0.24	8	18.6%
Neptune snail	*Neptunea* (no species recorded)	9	0.21	3	0.15	5	11.6%
lyre crab	*Hyas lyratus*	6	0.14	5	0.02	2	4.7%
giant Pacific octopus	*Octopus dofleini*	5	0.12	1	0.10	5	11.6%
Hind's scallop	*Chlamys rubida*	4	0.09	2	0.05	3	7.0%
kelp crab	*Pugettia gracilis*	4	0.09	2	0.05	3	7.0%
rough-eye rockfish	*Sebastes aleutianus*	3	0.07	2	0.02	2	4.7%
sun star	*Solaster* (no species recorded)	2	0.05	1	0.02	2	4.7%
yellow irish lord	*Hemilepidotus jordani*	2	0.05	2	0.00	1	2.3%
arrowtooth flounder	*Atheresthes stomias*	1	0.02	1	0.00	1	2.3%
basket star	*Gorgonocephalus caryi*	1	0.02	1	0.00	1	2.3%
Beringius snail	*Beringius* (no species recorded)	1	0.02	1	0.00	1	2.3%
blue mussel	*Mytilus edulis*	1	0.02	1	0.00	1	2.3%
dogwinkle	*Nucella lamellosa*	1	0.02	1	0.00	1	2.3%
flathead sole	*Hippoglossoides elassodon*	1	0.02	1	0.00	1	2.3%
hermit crab	*Pagurus* (no species recorded)	1	0.02	1	0.00	1	2.3%
red urchin	*Strongylocentrotus franciscanus*	1	0.02	1	0.00	1	2.3%
ribbed Neptune	*Neptunea lyrata*	1	0.02	1	0.00	1	2.3%
rockfish	*Sebastes* (no species recorded)	1	0.02	1	0.00	1	2.3%
sculpin	*Cottidae* (no species recorded)	1	0.02	1	0.00	1	2.3%

Table 6. The number of Tanner crab and octopi found in recovered pots, during the directed study, 1996.

Pot #	Pot Type	Minimum Age (years)	Torn Web	Depth (m)	Tanner Crab Live	Tanner Crab Carapace	Tanner Crab All	Giant Pacific Octopus
7	Rectangular	3	Y	150	1	0	1	0
11	Rectangular	3	N	82	0	0	0	1
12	Rectangular	5	Y	152	2	0	2	0
15	Rectangular	5	N	155	0	0	0	0
18	Rectangular	5	Y	155	8	0	8	0
48	Pyramid	3	N	140	1	0	1	0
57	Pyramid	3	N	154	0	0	0	0
74	Rectangular	5	N	158	1	0	1	0
79	Rectangular	5	Y	165	2	0	2	0
85	Rectangular	3	Y	76	0	0	0	0
92	Rectangular	3	N	161	9	8	17	1
94	Rectangular	3	Y	158	0	1	1	1
111	Rectangular	5	N	158	4	1	5	0
112	Pyramid	3	N	155	0	2	2	0
118	Rectangular	5	Y	164	0	1	1	0
120	Pyramid	5	Y	164	1	6	7	0
142	Rectangular	5	Y	164	1	0	1	0
143	Rectangular	5	N	147	9	1	10	1
149	Conical	5	Y	151	0	1	1	0
172	Rectangular	5	Y	145	7	0	7	0

Table 7. Pot types and biodegradeable twine information for pots recovered during the undirected study 1996.

Pot Type	Biodegradeable Twine: Not Recorded	Degraded	Intact	None	Number of Each Pot Type
55 gal. drum	0	0	0	1	1
cod	0	1	0	0	1
conical	0	2	1	8	10
pyramid	1	2	2	22	27
rectangular	0	14	1	30	45
round	0	0	0	9	9
shrimp	0	0	0	1	1
subsistence	0	0	0	2	2
Total	1	19	4	73	97

Table 8. A summary of the organisms within the 97 retrieved pots from the undirected study in 1996.

Common Name	Species Name	Total Caught	Average Caught	Max. # in a Pot	Average w/o Max & Min	Total # Pots w/ Species	Percent Pots w/ Species
Tanner crab All	*Chionoecetes bairdi*	132	1.36	125	0.07	5	5.2%
Tanner crab Live	*Chionoecetes bairdi*	125	1.29	118	0.07	5	5.2%
Tanner crab carapace	*Chionoecetes bairdi*	7	0.07	7	0.00	1	1.0%
sunflower sea star	*Pycnopodia helianthoides*	98	1.01	6	0.97	39	40.2%
green sea urchin	*Strongylocentrotus droebachiensis*	17	0.18	17	0.00	1	1.0%
hairy triton	*Fusitriton oregonensis*	14	0.14	3	0.12	8	8.2%
sea cucumber	*Holothuroidea* (no species recorded)	12	0.12	3	0.09	8	8.2%
anemone (white)	*Metridium senile*	10	0.10	6	0.04	3	3.1%
giant Pacific octopus	*Octopus dofleini*	8	0.08	3	0.05	6	6.2%
candlefish	*Mallosus villosus*	6	0.06	6	0.00	1	1.0%
decorator crab	*Oregonia gracilis*	5	0.05	3	0.02	2	2.1%
hermit crab	*Pagurus* (no species recorded)	4	0.04	2	0.02	3	3.1%
red king crab	*Paralithodes camtschatica*	4	0.04	3	0.01	2	2.1%
sculpin	*Cottidae* (no species recorded)	4	0.04	1	0.03	4	4.1%
kelp crab	*Pugettia gracilis*	3	0.03	3	0.00	1	1.0%
lyre crab	*Hyas lyratus*	3	0.03	2	0.01	2	2.1%
rough-eye rockfish	*Sebastes aleutianus*	2	0.02	1	0.01	2	2.1%
sun star	*Solaster* (no species recorded)	2	0.02	2	0.00	1	1.0%
yellow irish lord	*Hemilepidotus jordani*	2	0.02	2	0.00	1	1.0%
Pacific cod	*Gadus macrocephalus*	2	0.02	1	0.01	2	2.0%
mottled sea star	*Evasterias troschelii*	1	0.01	1	0.00	1	1.0%
rockfish	*Sebastes* (no species recorded)	1	0.01	1	0.00	1	1.0%

Table 9. The number of Tanner and red king crab and octopi, found in pots, during the undirected study 1996.

Pot #	Pot Type	Minimum Age (years)	Torn Web	Depth (m)	Tanner Crab Live	Tanner Crab Carapace	Tanner Crab All	Red King Crab	Giant Pacific Octopus
1001	Pyramid	1	N	161	118	7	125	0	1
1002	Conical	5	N	13	0	0	0	0	1
1004	Rectangular	3	Y	14	0	0	0	0	0
1007	Pyramid	0	N	82	2	0	2	0	0
2023	Conical	3	Y	66	0	0	0	0	1
2027	Rectangular	1	Y	44	0	0	0	0	1
2032	Rectangular	5	Y	82	0	0	0	0	1
2046	Rectangular	3	N	95	0	0	0	3	0
2048	Rectangular	3	N	97	3	0	3	0	0
2057	Rectangular	3	N	75	0	0	0	0	3
2058	Rectangular	3	N	145	0	0	0	0	0
2063	Subsistence	0	N	164	1	0	1	1	0
2065	Rectangular	3	N	86	0	0	0	0	0
2066	Shrimp	3	Y	86	1	0	1	0	0
2067	Conical	3	N	67	0	0	0	0	0
2076	Rectangular	3	Y	68	0	0	0	0	0

Table 10. Pot types and biodegradeable twine information for pots recovered during the directed and undirected studies (combined) 1996.

Pot Type	Biodegradeable Twine: Not Recorded	Degraded	Intact	None	Number of Each Pot Type
55 gal. drum	0	0	0	1	1
cod	0	2	0	0	2
conical	0	4	1	14	19
pyramid	1	4	2	28	35
rectangular	1	23	1	46	71
round	0	0	0	9	9
shrimp	0	0	0	1	1
subsistence	0	0	0	2	2
Total	2	33	4	101	140

Table 11. A summary of the organisms within the 140 retrieved pots from the directed and undirected studies (combined) in 1996.

Common Name	Species Name	Total Caught	Average Caught	Max. # in a Pot	Average w/o Max & Min	Total # Pots w/ Species	Percent Pots w/ Species
Tanner crab All	*Chionoecetes bairdi*	199	1.42	125	0.54	21	15.0%
Tanner crab Live	*Chionoecetes bairdi*	171	1.22	118	0.38	17	12.1%
Tanner crab carapace	*Chionoecetes bairdi*	28	0.20	8	0.14	9	6.4%
sunflower sea star	*Pycnopodia helianthoides*	187	1.34	13	1.26	61	43.6%
hairy triton	*Fusitriton oregonensis*	174	1.24	50	0.90	22	15.7%
anemone (white)	*Metridium senile*	64	0.46	50	0.10	5	3.6%
tube worms	*Crucigera* (no species recorded)	50	0.36	50	0.00	1	0.7%
green sea urchin	*Strongylocentrotus droebachiensis*	37	0.26	17	0.14	10	7.1%
decorator crab	*Oregonia gracilis*	17	0.12	3	0.10	10	7.1%
giant Pacific octopus	*Octopus dofleini*	13	0.09	3	0.07	11	7.9%
sea cucumber	*Holothuroidea* (no species recorded)	12	0.09	3	0.07	8	5.7%
lyre crab	*Hyas lyratus*	9	0.06	5	0.03	4	2.9%
Neptune snail	*Neptunea* (no species recorded)	9	0.06	3	0.04	5	3.6%
kelp crab	*Pugettia gracilis*	7	0.05	3	0.03	4	2.9%
candlefish	*Mallosus villosus*	6	0.04	6	0.00	1	0.7%
hermit crab	*Pagurus* (no species recorded)	5	0.04	2	0.02	4	2.9%
rough-eye rockfish	*Sebastes aleutianus*	5	0.04	2	0.02	4	2.9%
sculpin	*Cottidae* (no species recorded)	5	0.04	1	0.03	5	3.6%
Hind's scallop	*Chlamys rubida*	4	0.03	2	0.01	3	2.1%
red king crab	*Paralithodes camtschatica*	4	0.03	3	0.01	2	1.4%
sun star	*Solaster* (no species recorded)	4	0.03	2	0.01	3	2.1%
yellow irish lord	*Hemilepidotus jordani*	4	0.03	2	0.01	2	1.4%
Pacific cod	*Gadus macrocephalus*	2	0.01	1	0.01	2	1.4%
rockfish	*Sebastes* (no species recorded)	2	0.01	1	0.01	2	1.4%
arrowtooth flounder	*Atheresthes stomias*	1	0.01	1	0.00	1	0.7%
basket star	*Gorgonocephalus caryi*	1	0.01	1	0.00	1	0.7%
Beringius snail	*Beringius* (no species recorded)	1	0.01	1	0.00	1	0.7%
blue mussel	*Mytilus edulis*	1	0.01	1	0.00	1	0.7%
dogwinkle	*Nucella lamellosa*	1	0.01	1	0.00	1	0.7%
flathead sole	*Hippoglossoides elassodon*	1	0.01	1	0.00	1	0.7%
mottled sea star	*Evasterias troschelii*	1	0.01	1	0.00	1	0.7%
red urchin	*Strongylocentrotus franciscanus*	1	0.01	1	0.00	1	0.7%
ribbed Neptune	*Neptunea lyrata*	1	0.01	1	0.00	1	0.7%

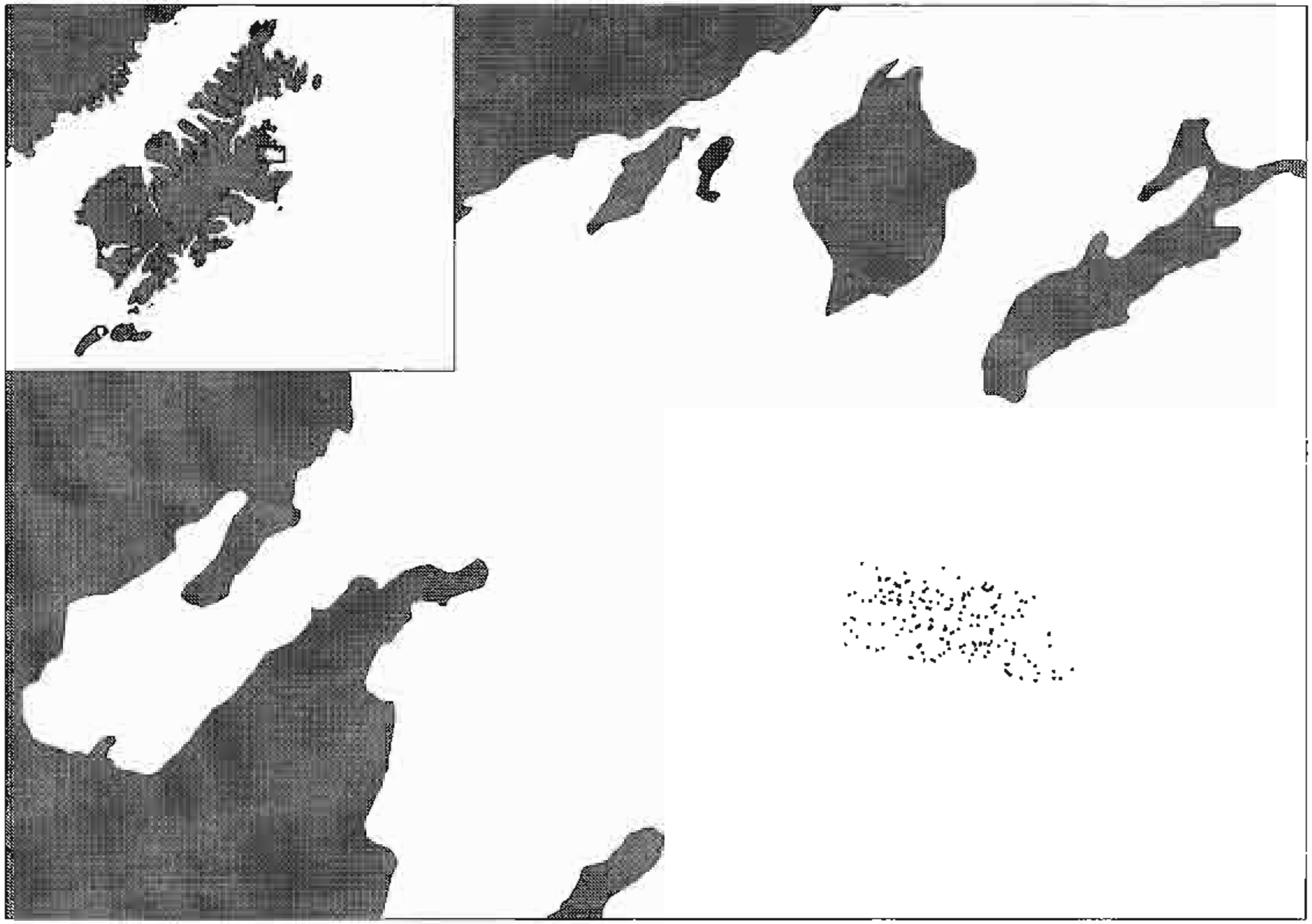


Figure 1. Map of Kodiak, and the Chiniak area, along with the location of lost pots identified by sidescan sonar, in 1994.

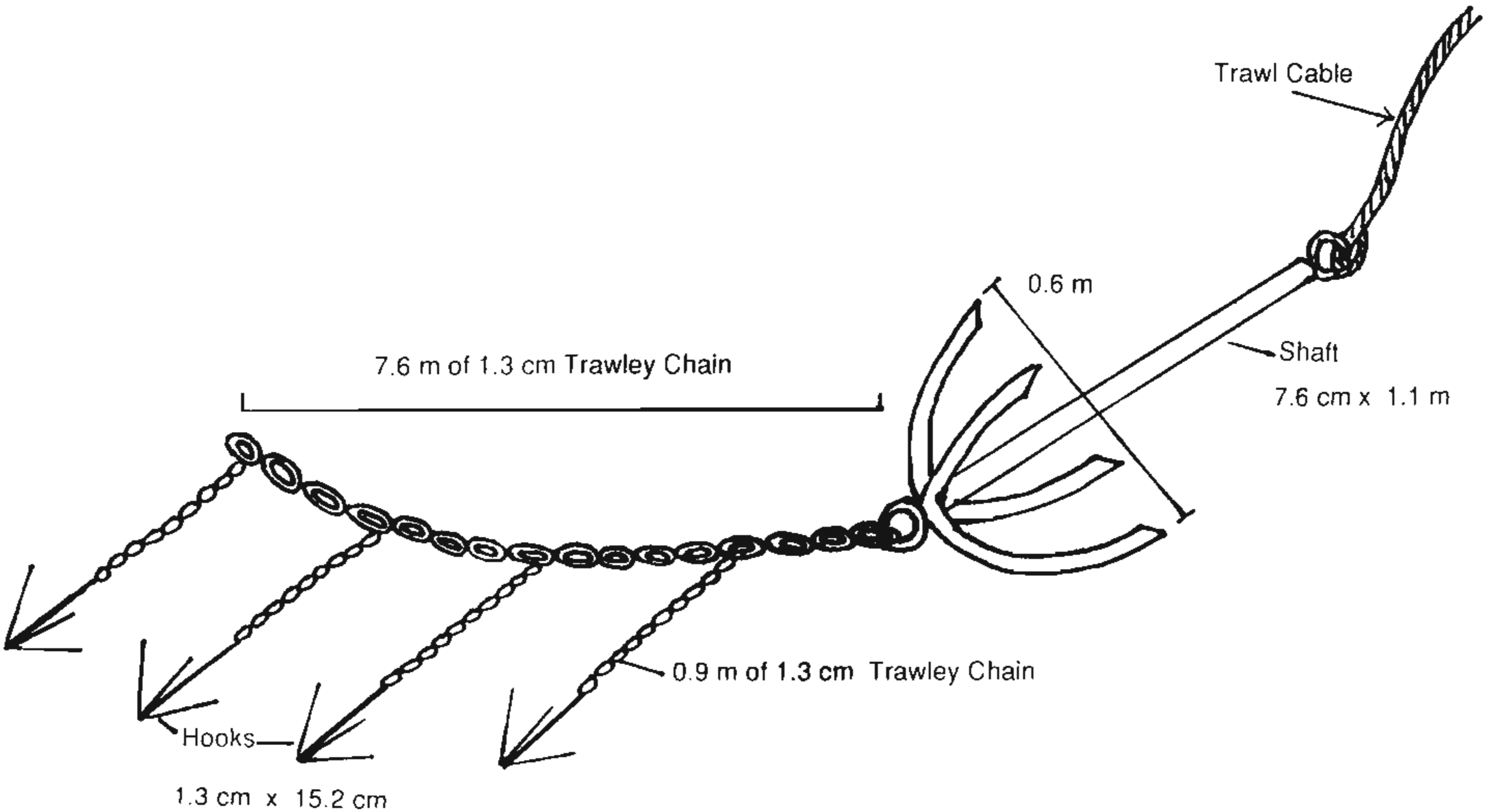


Figure 2. Grappling device initially used by the R/V Resolution during the pilot study, 1995.

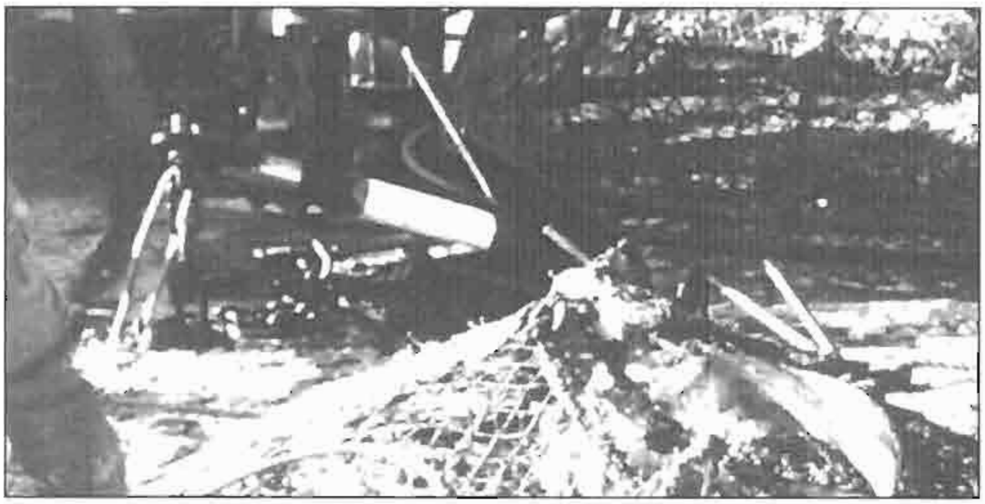


Figure 3. A photograph of the grappling device employed during the pilot study 1995.

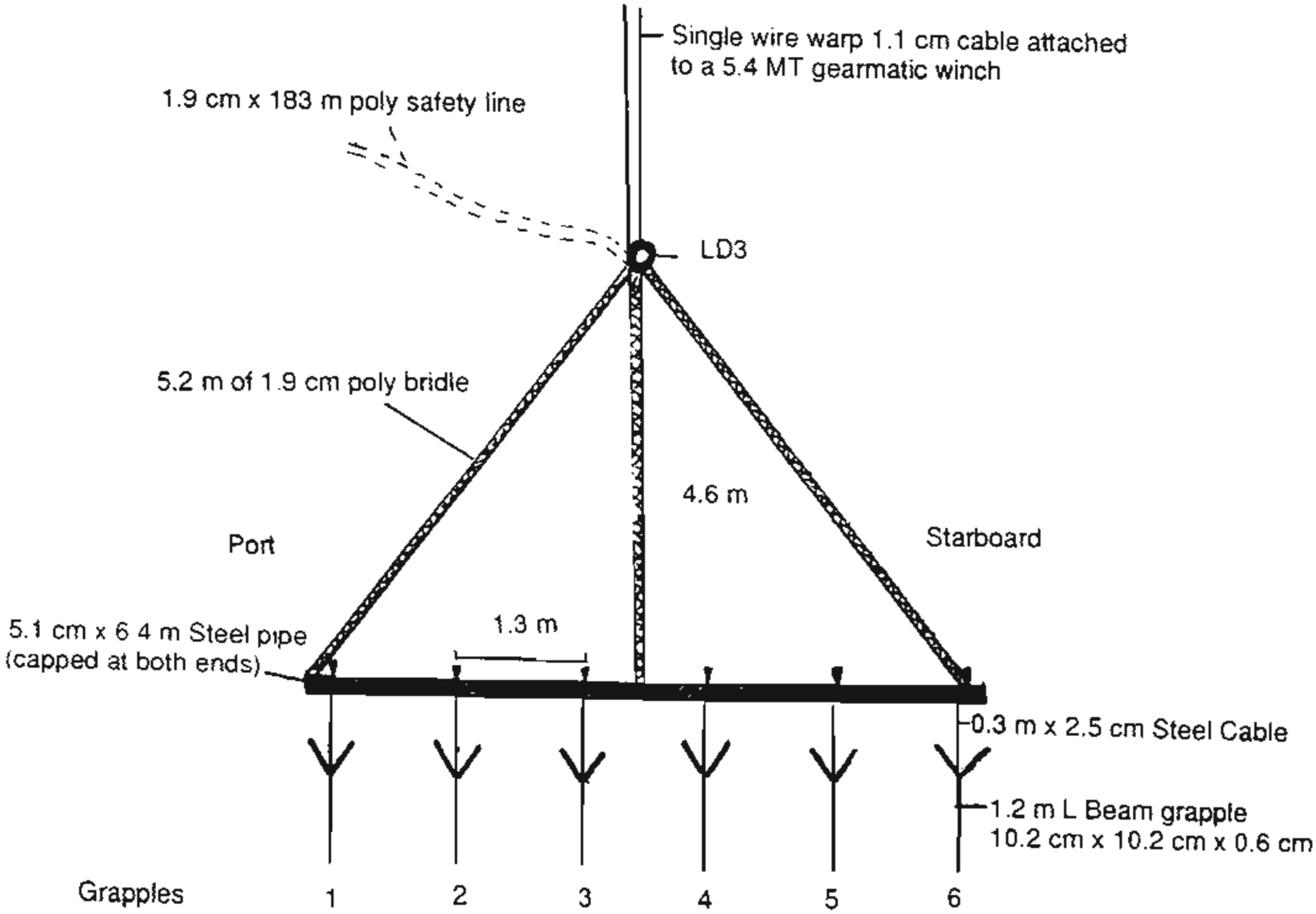


Figure 4. Original 6.4 m pot grapple beam device that consists of a 5.2 m bridle attached at one end by a 1.1 cm single wire to a 5.4 mt gearmatic winch, and at the other end with 6 grapples attached by 2.5 cm steel cable to a 5.1 cm steel pipe.

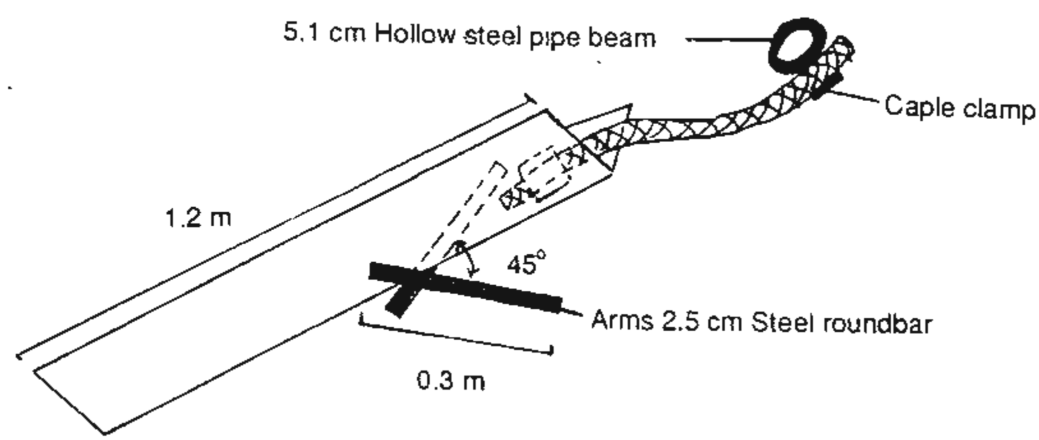


Figure 5. Original grapple design has 2 arms of 2.5 cm roundbar, 0.3 m long attached to a 1.2 m "L" beam at a 45 degree angle

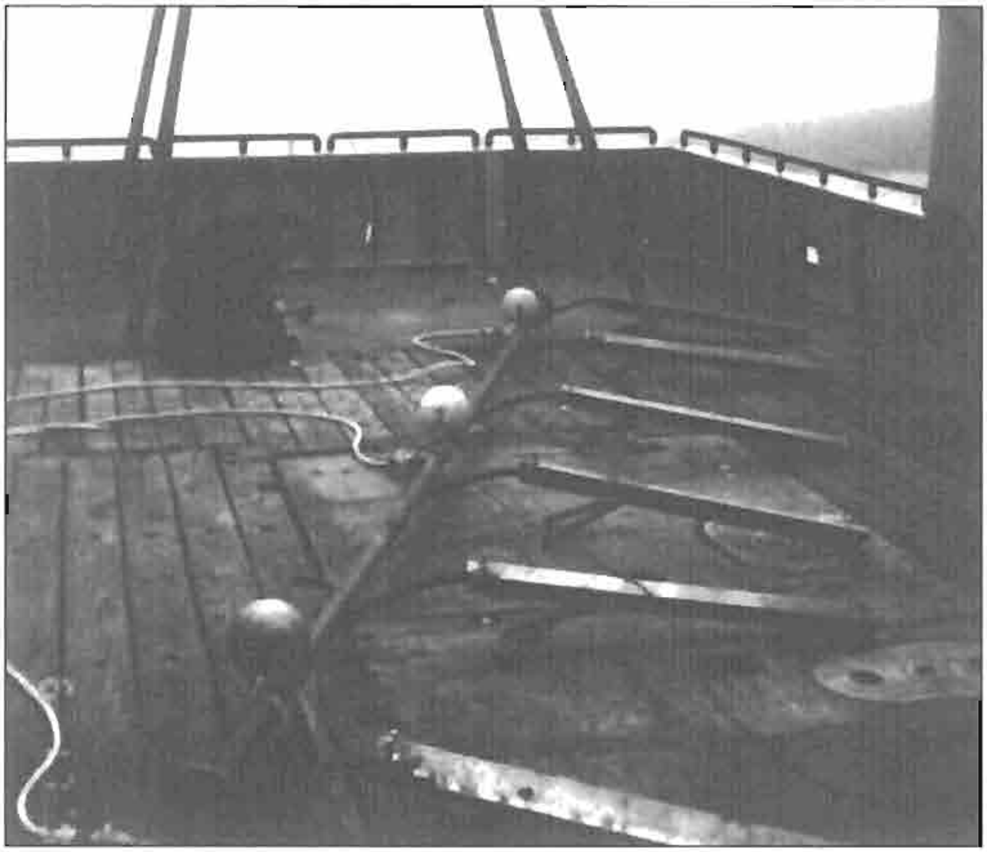


Figure 6. A photograph of the grappling device employed during most of the directed study, 1996.

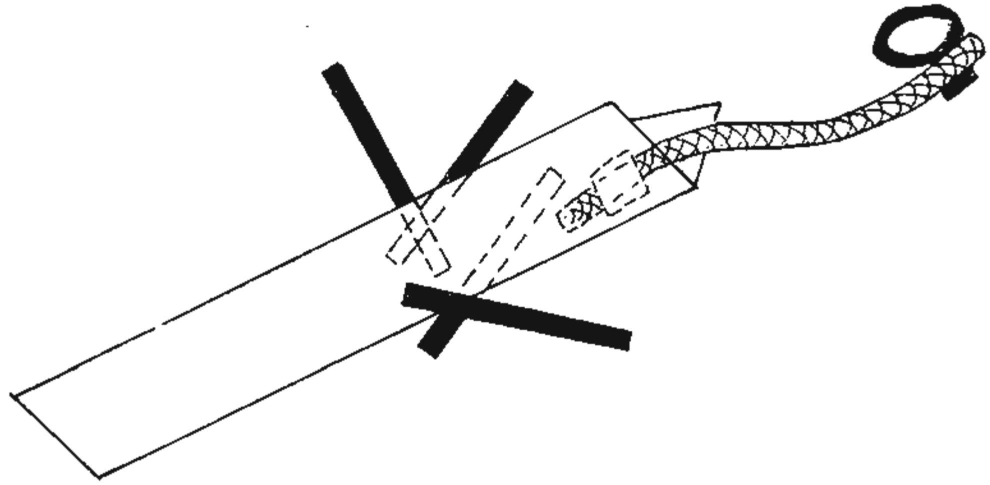


Figure 7. Modification to the original grapple with two additional tines welded to the inside of the "L" beam.

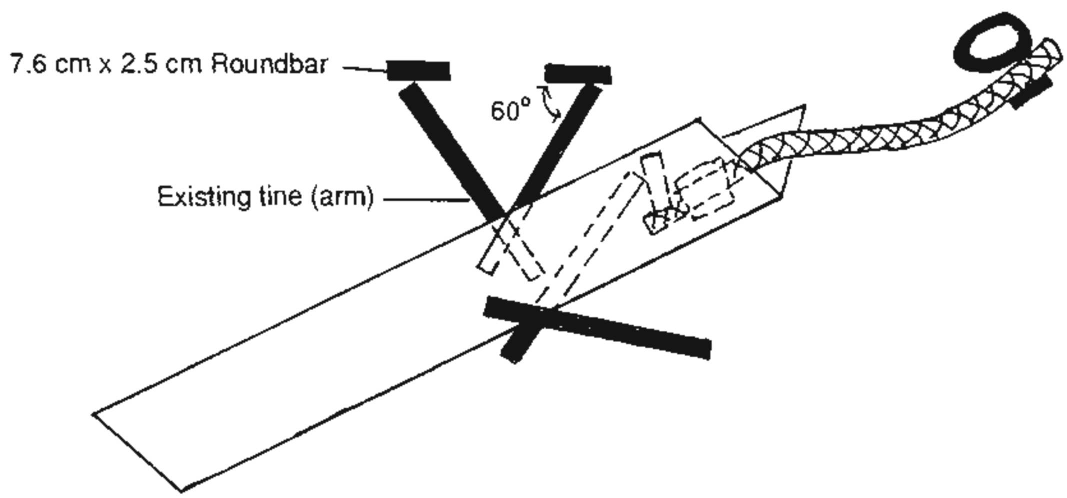


Figure 8. Second modification to the original grapple design with 7.6 cm x 2.5 cm roundbar welded to the end of each existing tine at a 60 degree angle.

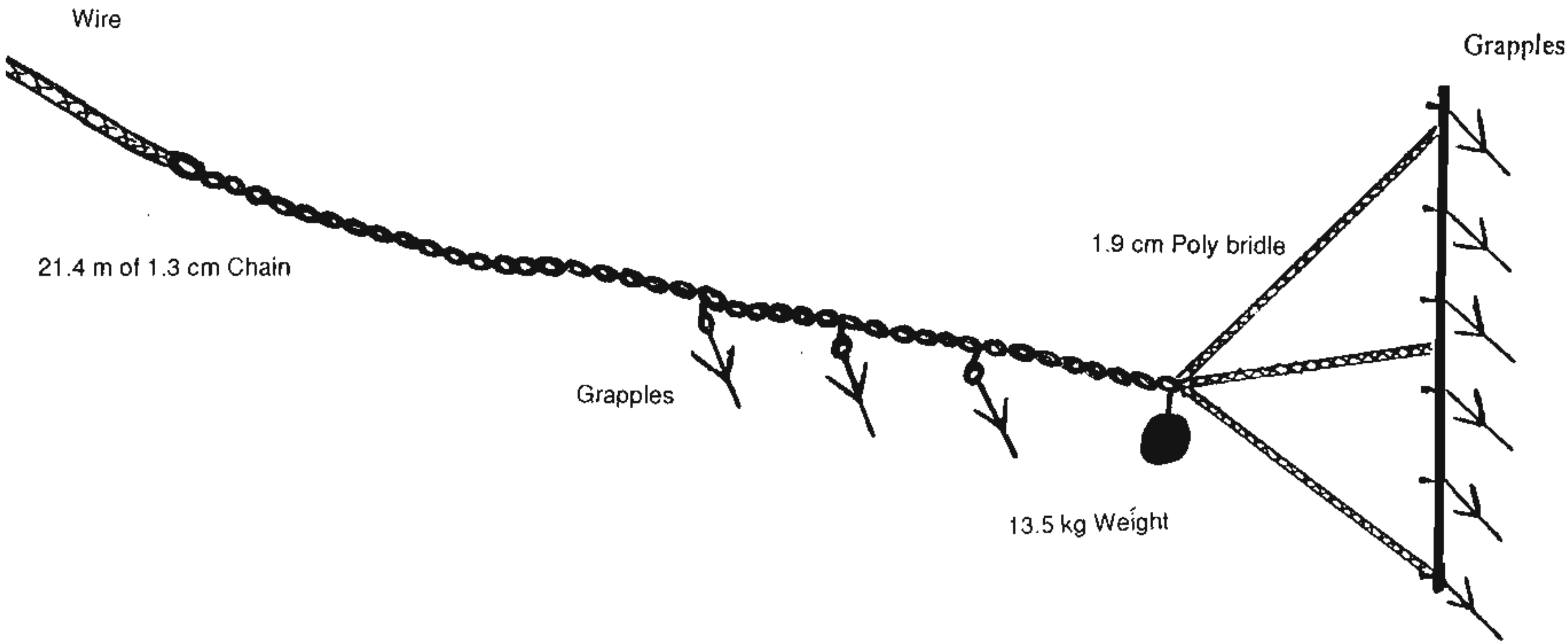


Figure 9. Gear adjustment done on June 29, 1996. A 21.4 m section of 1.3 cm chain was added to the single wire wrap cable. The chain had quick release links on it so additional grapples (up to 6) could be added to the beam grappling device.

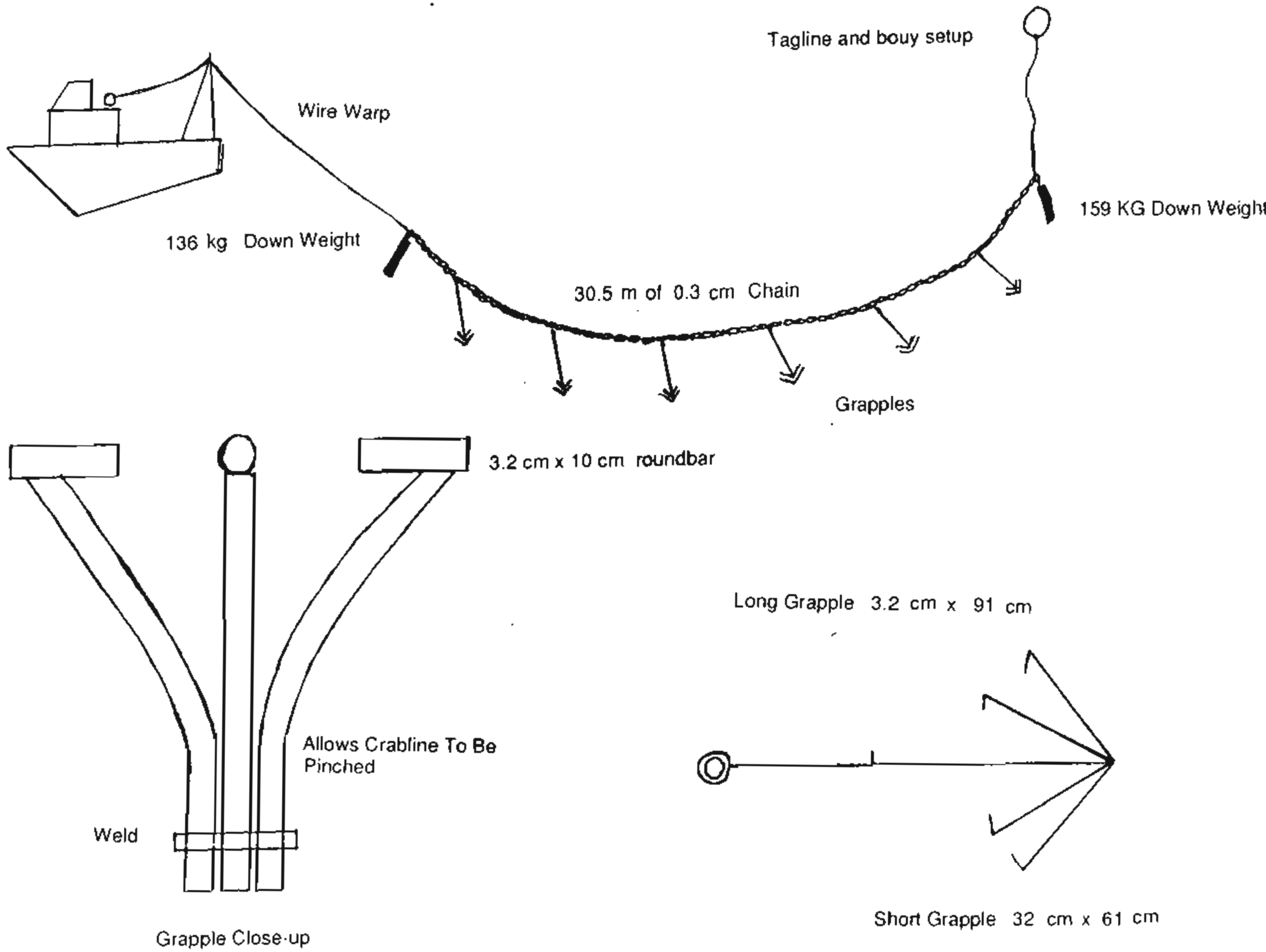


Figure 10. Grappling setup and grapples used during most of the undirected study, 1996.

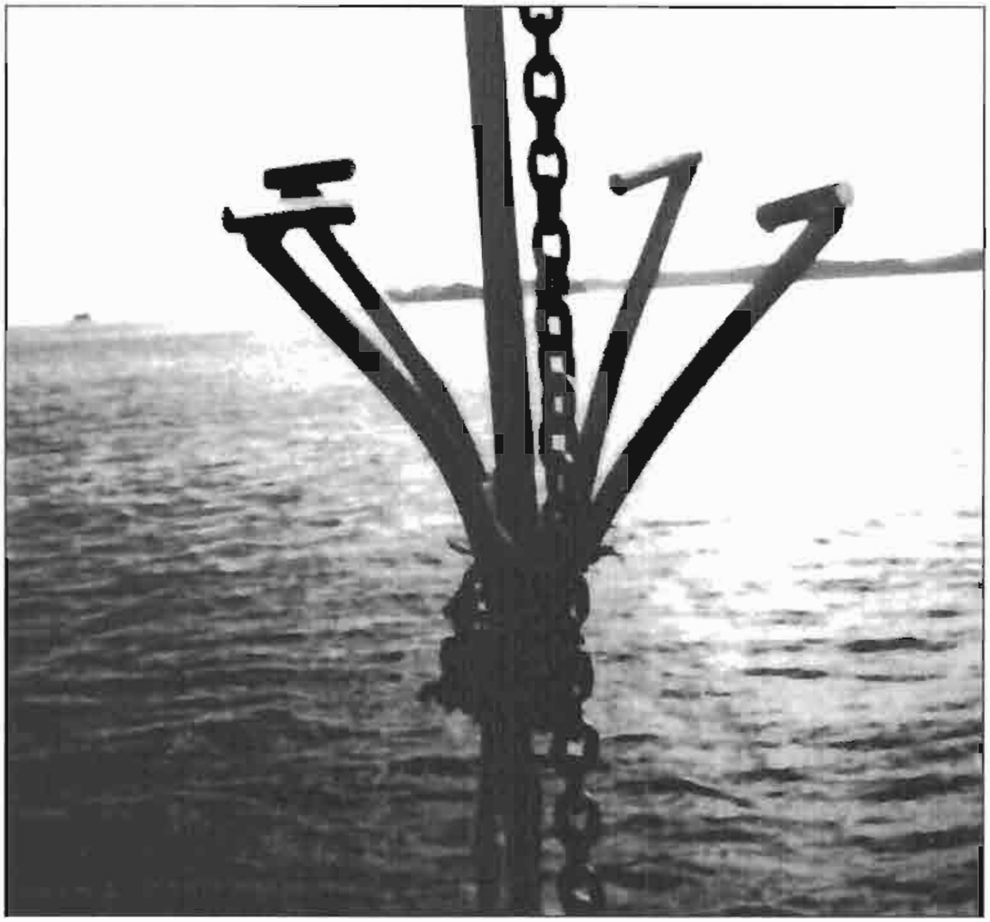


Figure 11. A photograph of the grappling device employed during the undirected study, 1996.

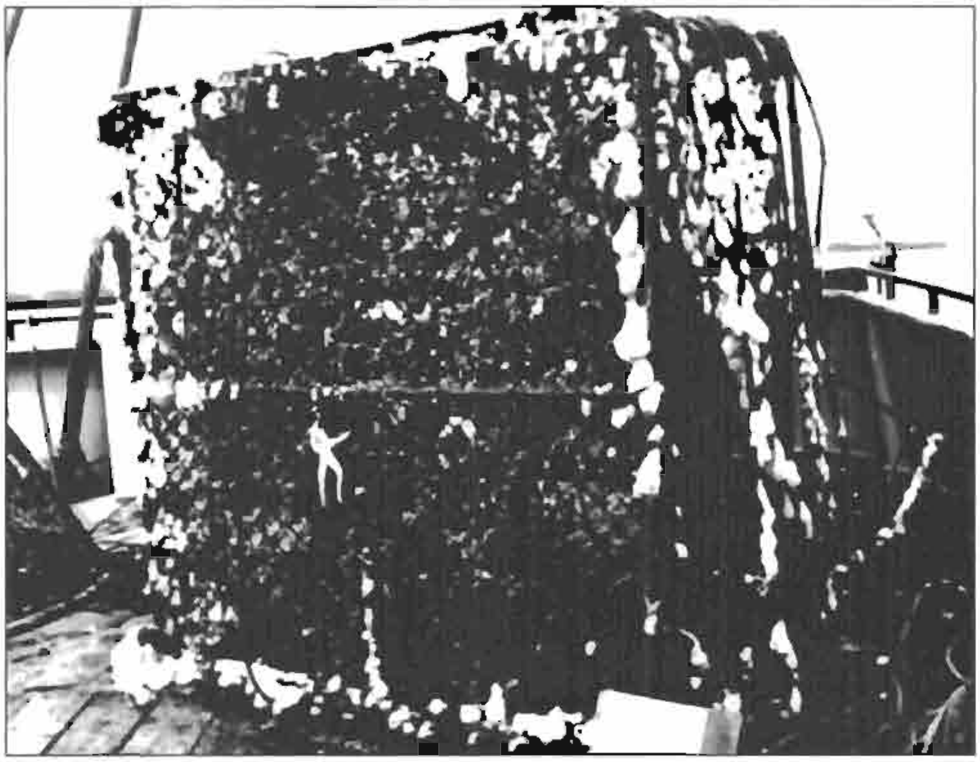


Figure 12. A photograph of a rectangular crab pot heavily encrusted with biota.

Figure 13. A photograph of a rectangular crab pot lightly encrusted with biota.

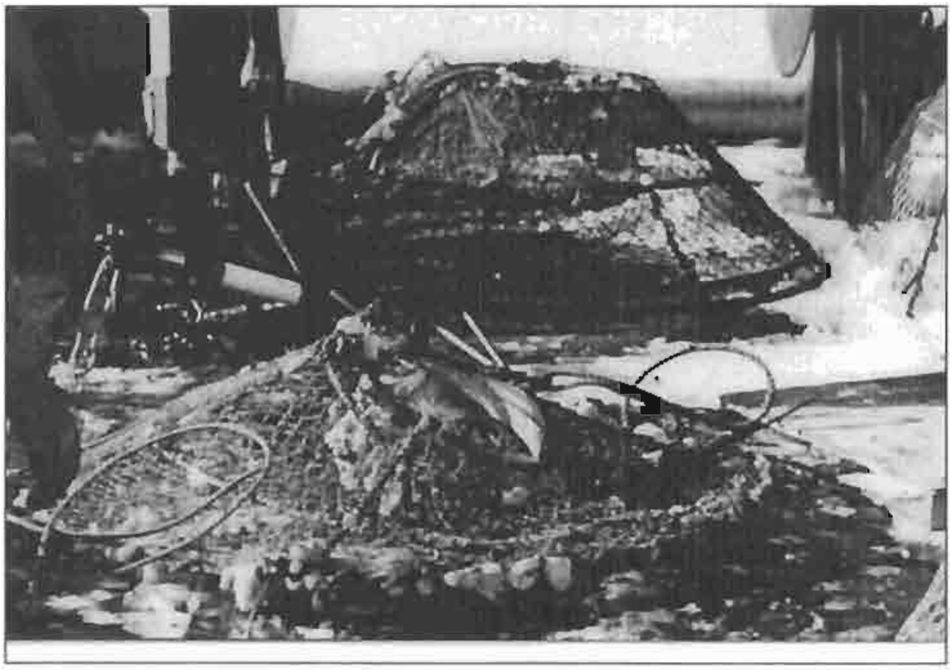


Figure 14. Two conical crab pots, one in good condition and could likely be reused (background), whereas the other is in poor condition (foreground).

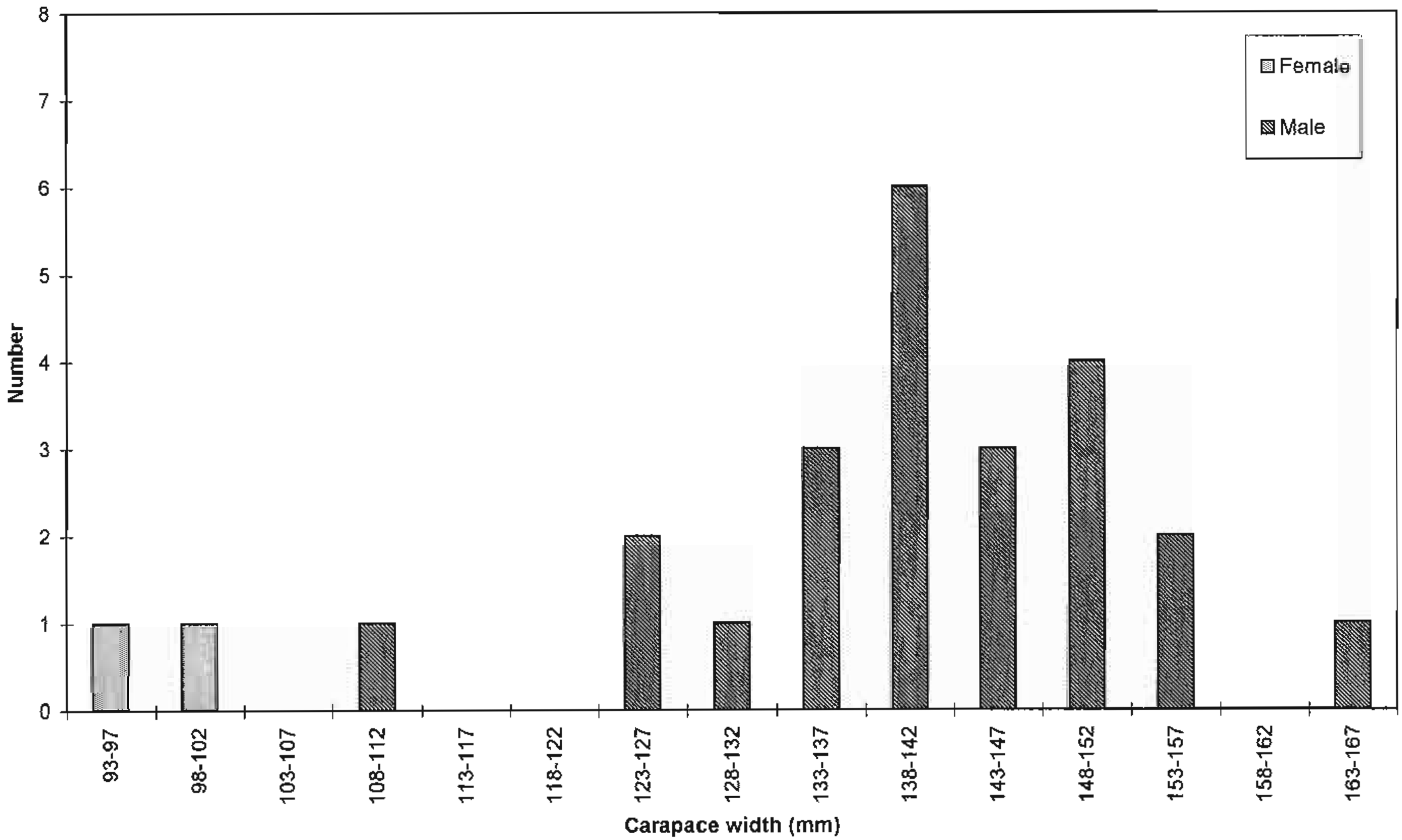


Figure 15. Carapace width (mm) of male and female Tanner crab retrieved from the lost pots, during the pilot study in 1995.

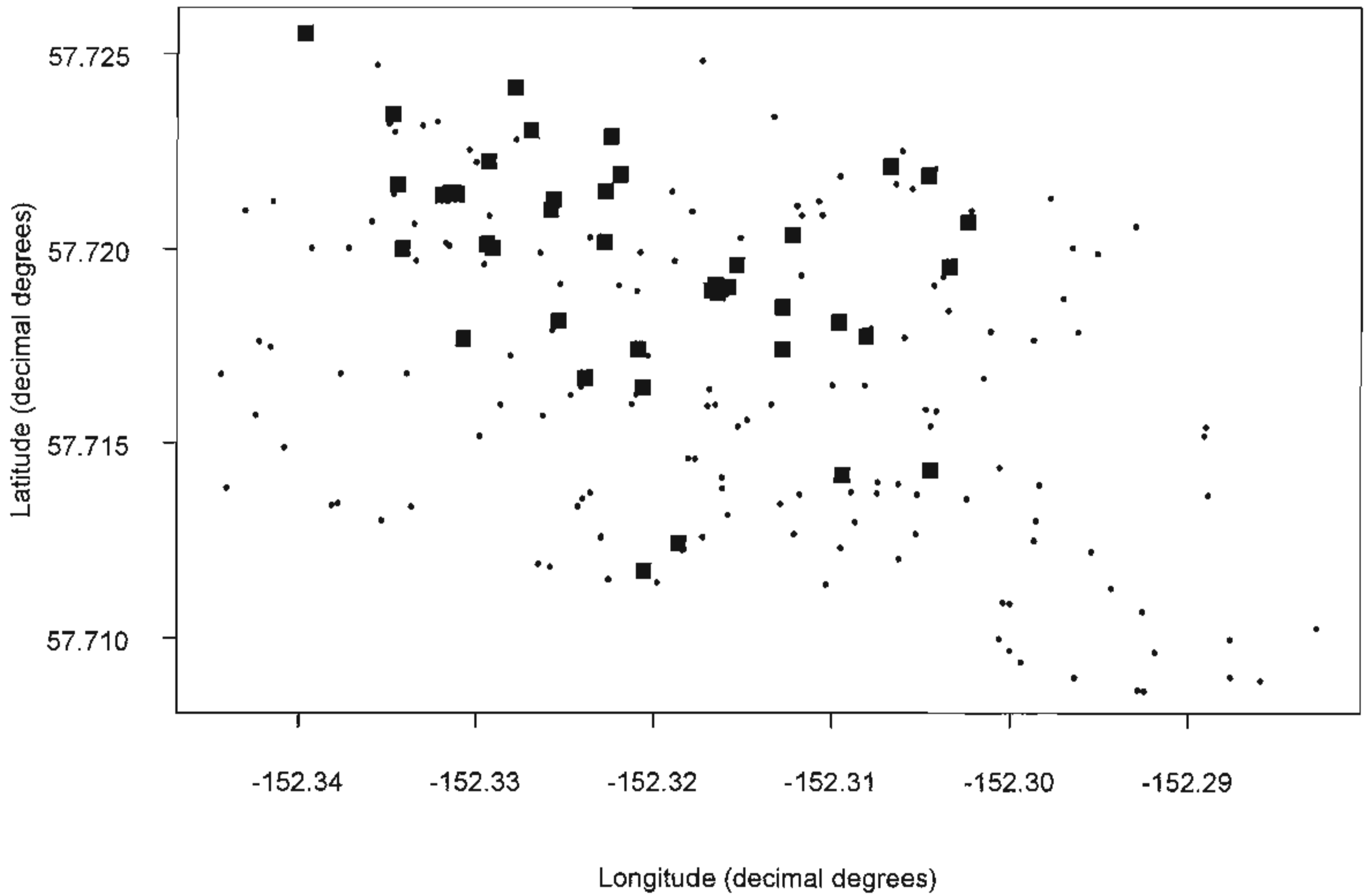


Figure 16. Coordinates of pots in decimal degree longitude and latitude, identified by sidescan sonar, along with those presumed recovered (■) during the directed study, 1996.

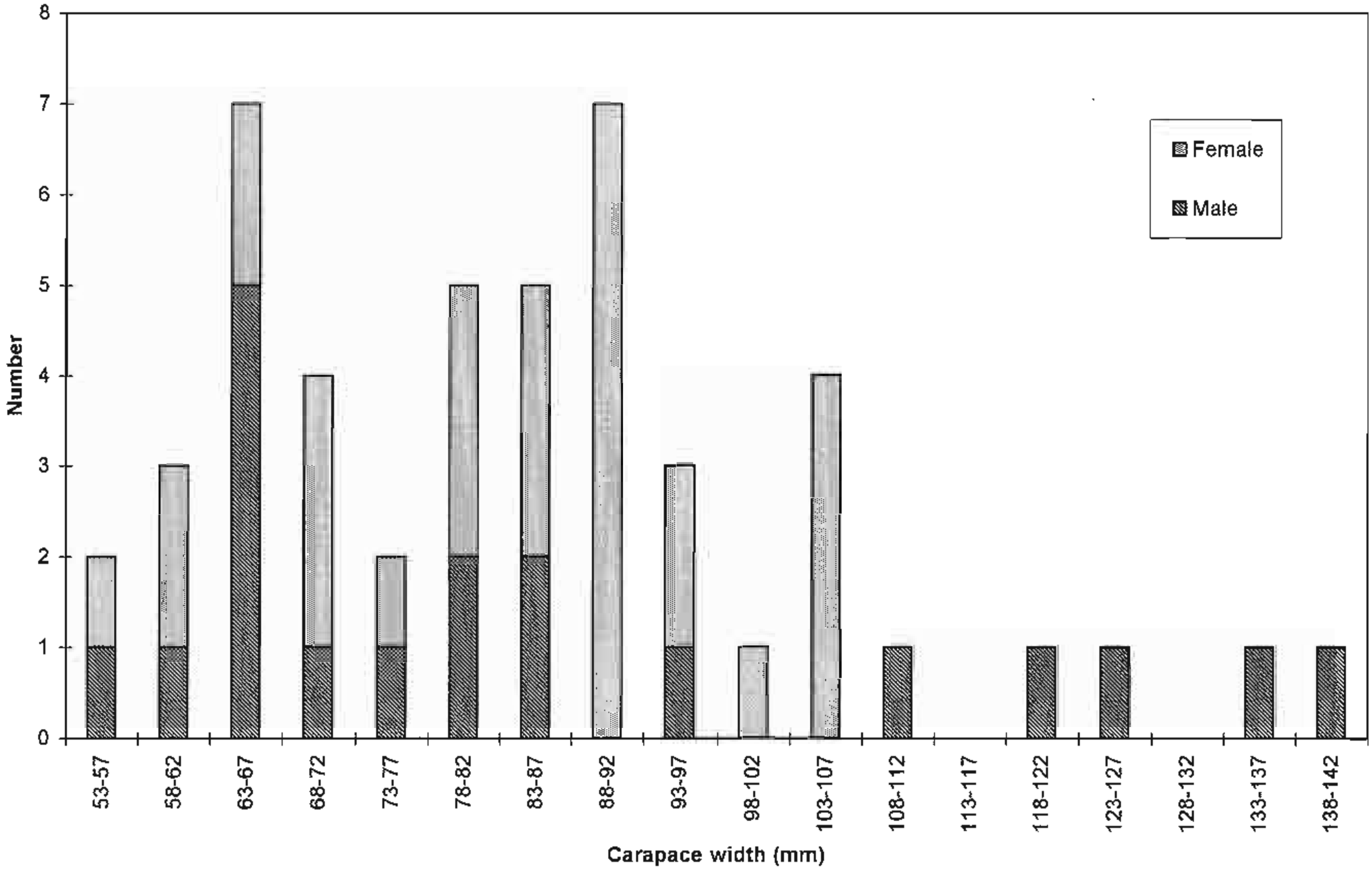


Figure 17. Carapace width (mm) of male and female Tanner crab retrieved from lost pots, during the directed study in 1996.

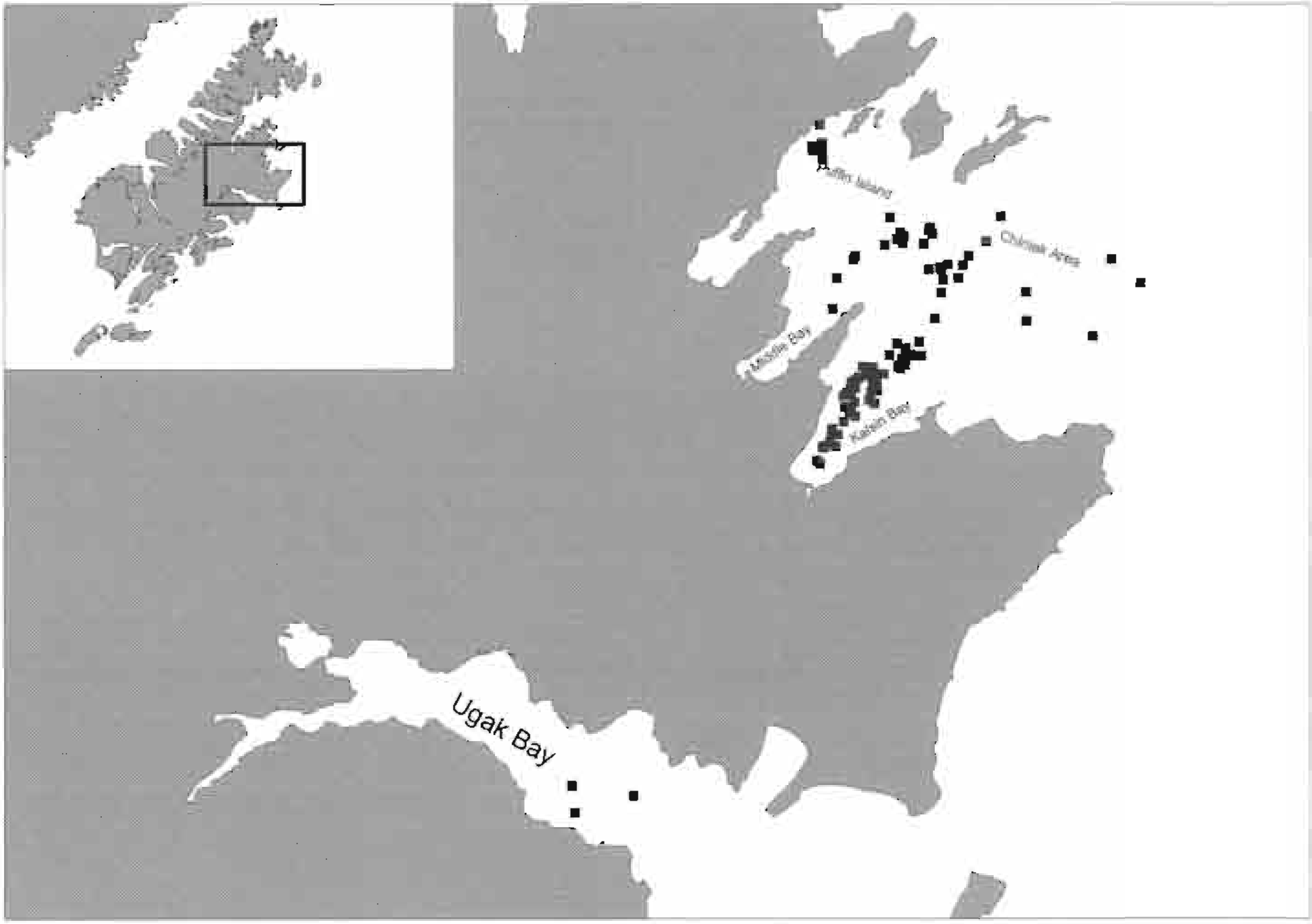


Figure 18. Pot locations of pots recovered during the undirected study, 1996. Also important geographic information.

Figure 19. A photograph of pot #1001, with the 125 Tanner crab (118 live and 7 empty carapaces) and the octopus.

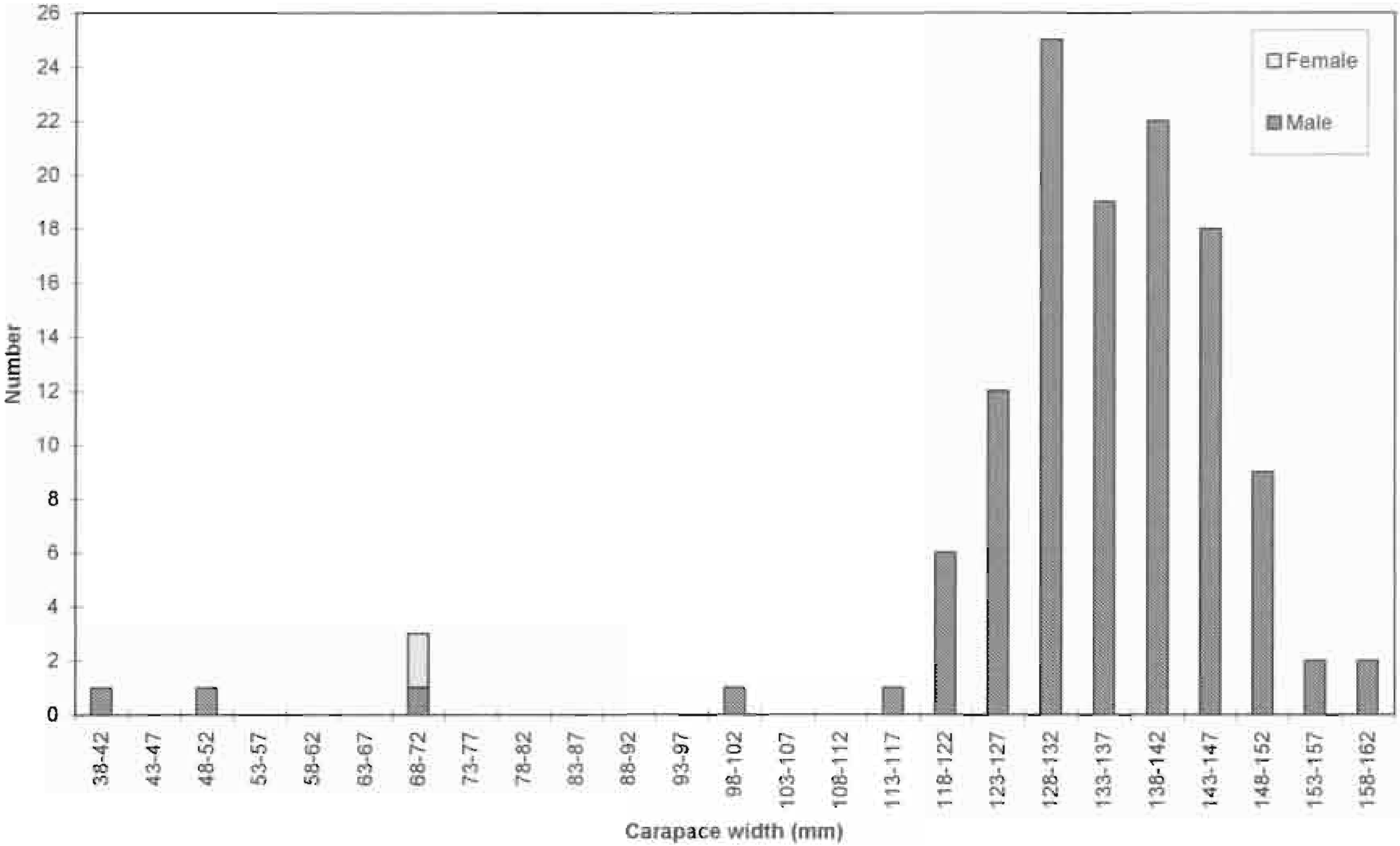


Figure 20. Carapace width (mm) of male and female Tanner crabs retrieved from the lost pots, during the undirected study in 1996.

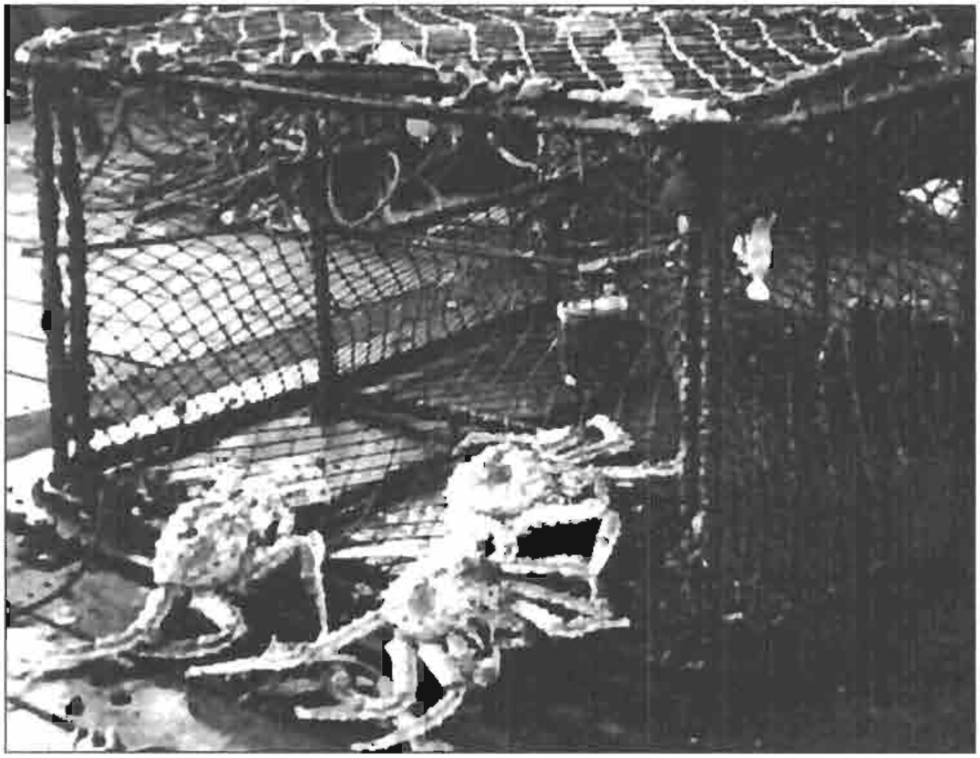


Figure 21. A photograph of pot # 2046, with the three legal red king crab.

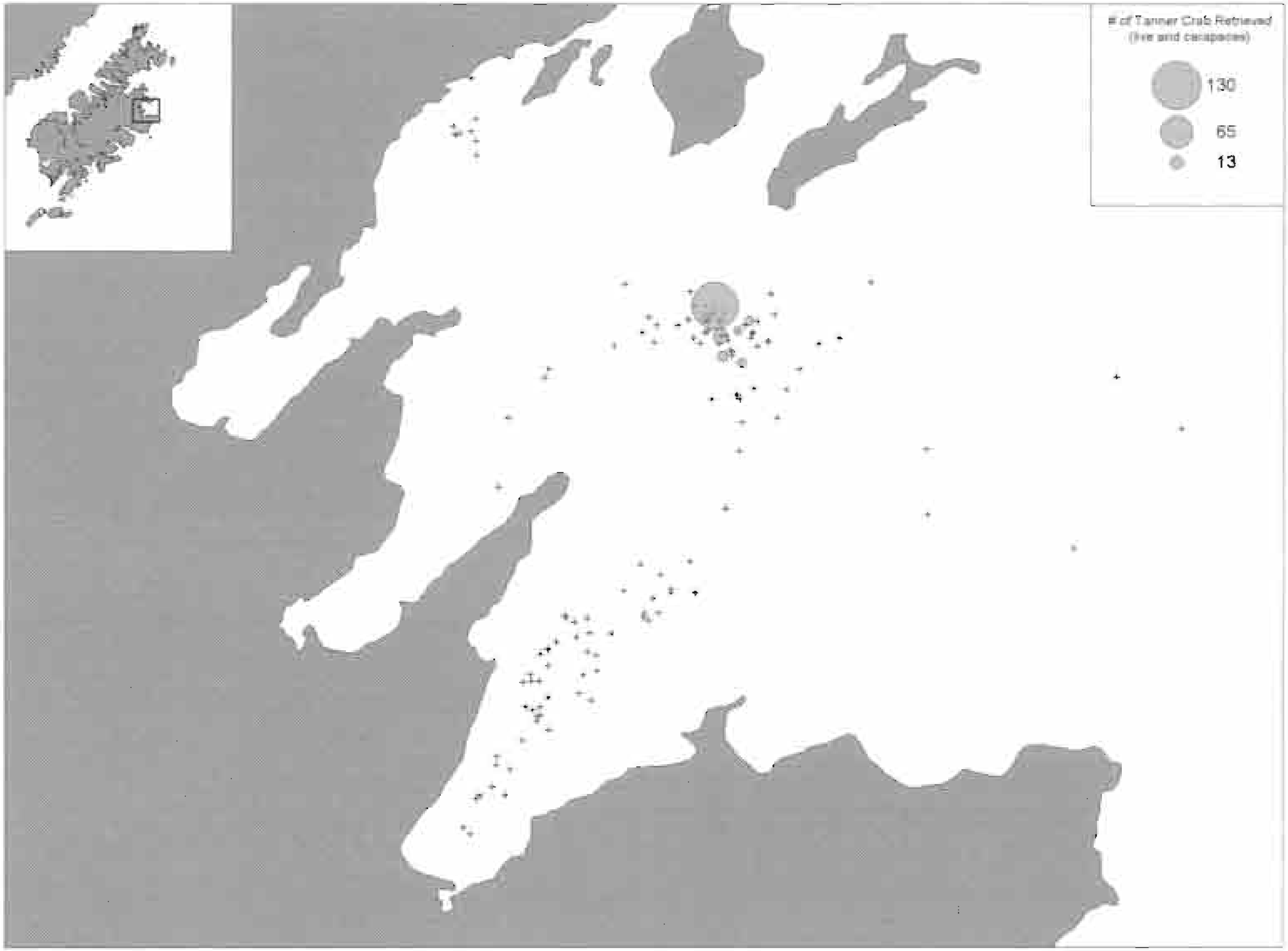


Figure 22. Map of pot location from the directed and undirected studies of 1996, along with relative number of Tanner crab retrieved.

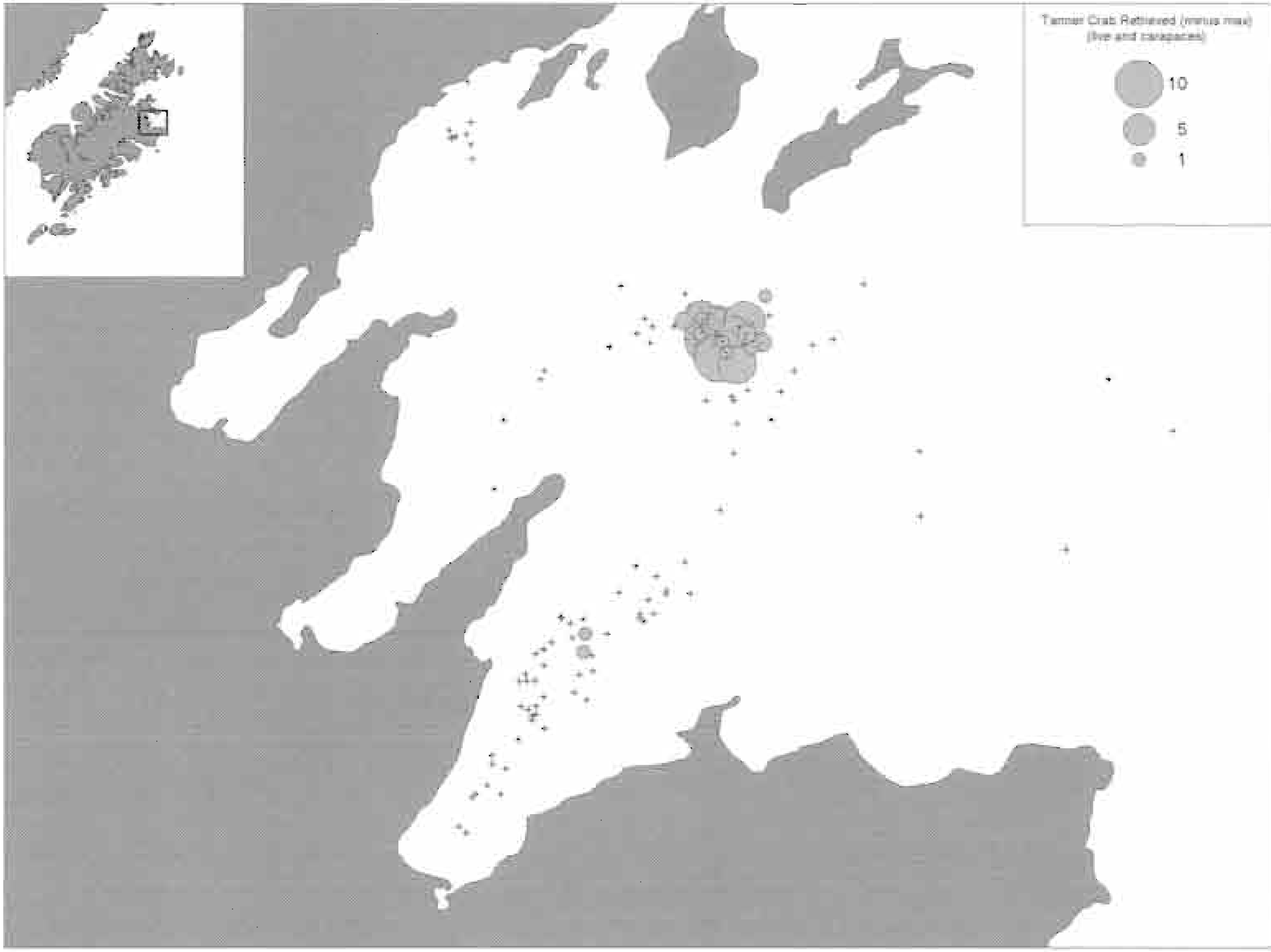


Figure 23. Map of pot location from the directed and undirected studies of 1996, along with relative number of Tanner crab retrieved but not including pot number 1001 which had 125 Tanner crab in it.

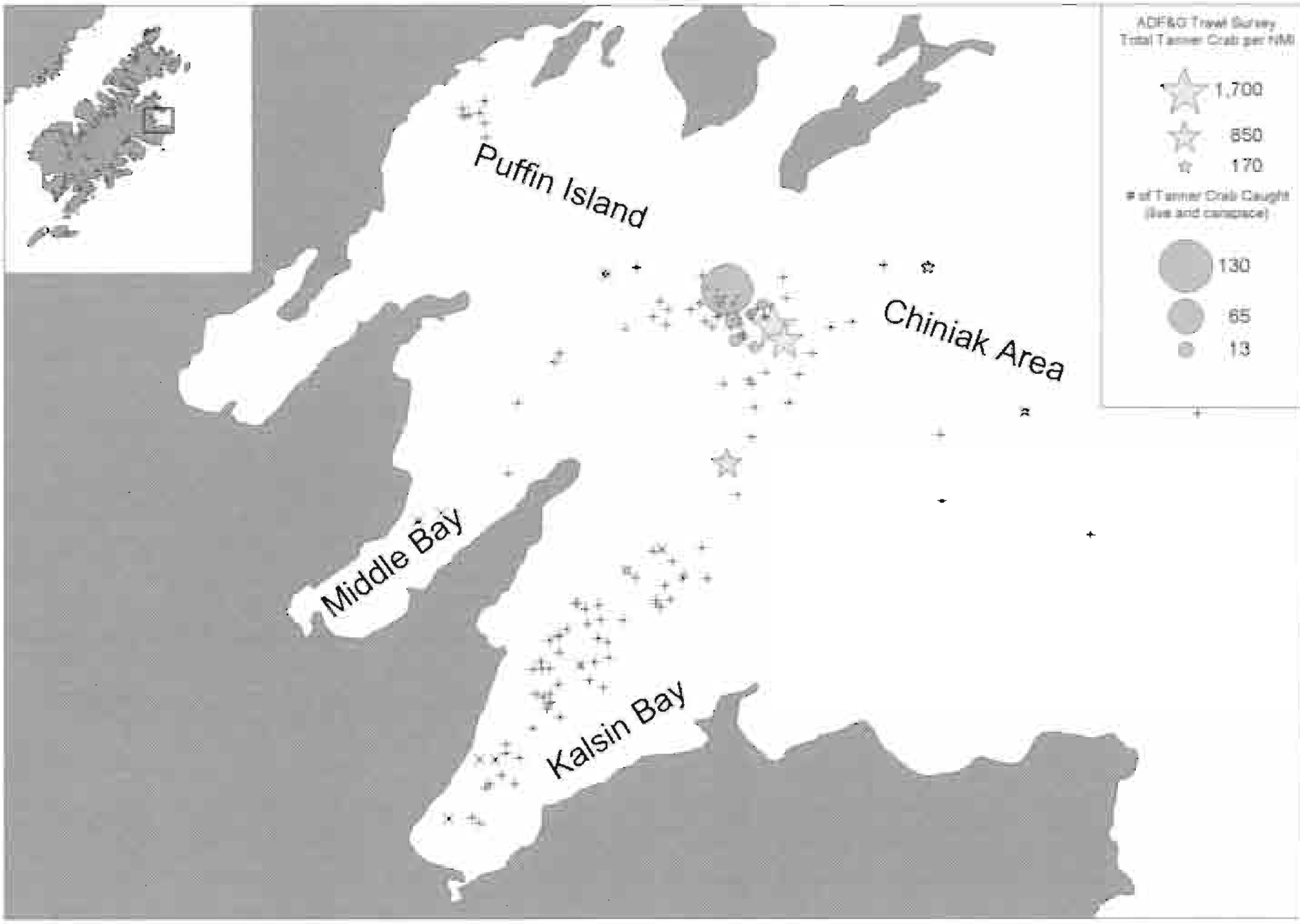


Figure 24. Pot (+) and trawl (x) locations along with total Tanner crab caught by each within the study areas.

APPENDIX

Appendix A.1. Letter, report, and map from the sidescan survey.

National Marine Fisheries Service
Alaska Fisheries Science Center
P.O. Box 1638
Kodiak, Alaska 99615-1638
(907)487-4961 fax (907)487-4960

27 January 1995

Dr. Ray Highsmith, Director
West Coast National Undersea Research Center
School of Fisheries and Ocean Sciences
University of Alaska, Fairbanks
Fairbanks, AK 99775-1090

Dear Ray,

Enclosed is our year-end report for 1994. It looks a lot like the Quick Response report we sent earlier; although we completed all of our crab dissections and examinations, we still have much of the video analysis to complete. I have not had the time to produce copies of video tape or slides for you, but promise to do that within the next few months.

I have also enclosed a tentative schedule of our activities this spring. We will have the ADFG Resolution for about 20 days of this time, and NMFS will charter a vessel for the remaining time. This year, we are also getting some support from the National Geographic Society. Unfortunately, they are locked into a specific schedule, so we will have to split up our use of the UNCW ROV into two 10-day periods. If necessary, we will purchase another RT ticket for the operator to return home in between that time.

In addition, we will probably be getting some money from the U.S. Army Corps of Engineers to supplement our ghost pot study. This money should allow us to beef up our navigation system contract, and, in addition to funds from ADFG and NMFS, to charter the *Delta* submersible for 10-day period in late April.

It's going to be a busy spring!

Sincerely,

Bradley G. Stevens

Bradley G. Stevens
Supervisory Fishery Biologist

cc: Bill Donaldson, ADFG

Enclosures

NATIONAL UNDERSEA RESEARCH PROGRAM YEAR-END REPORT

DATE:	27 January 1995
PROJECT TITLE:	Aspects of a mating aggregation of Tanner crabs, Chionoecetes bairdi.
PROJECT DATES:	6 to 27 April, 1994.
PRINCIPAL INVESTIGATOR:	Dr. Bradley G. Stevens National Marine Fisheries Service
CO-INVESTIGATORS:	Bill Donaldson, Alaska Dept. Fish and Game Jan Haaga, NMFS

A. INITIAL RESULTS AND ACHIEVEMENTS

Our project consisted of two separate but related efforts. Phase 1 involved searching a portion of Chiniak Bay, Kodiak Alaska, with sidescan sonar for the presence of crab mounds. Phase 2 involved using the *Delta* submersible to locate, observe, and sample crabs from a mating aggregation.

Phase 1: Sonar Survey:

NMFS contracted with SAIC, of San Diego, CA, to supply and operate a dual frequency (100/500 KHz) sidescan sonar system (Klein model 595), with a digital data signal processor, and a differential GPS system to allow accurate positioning of equipment and data records. This equipment was set up and operated from the ADFG vessel Resolution during 6-8 April, 1994 for approx. 32 hr. The equipment worked very well, and provided high resolution charts of the seafloor over an area of approx. 6 km^2. Transects were run at distances of 75 m apart, such that the scanning of each line overlapped those on each side by 50%, providing total coverage of 150%.

We did not find any targets which appeared to be mounds of crabs. Bottom returns from the area where crabs had been observed in 1991-93 (site CRAB91) were extremely flat, and devoid of any variations in substrate, except for occasional rock outcrops. We did, however, observe many anthropogenic objects which appeared to be crab pots, some apparently still with attached lines, and a large scar (.5 m high by 3-5 m wide) where something had been dragged for several miles in a straight line. Later observations in the sub failed to reveal the drag scar even though we crossed the area several times.

As a final product of this phase, SAIC prepared a surface features map of the area surveyed, which showed approximately 189 'crab pots' in the 6 km^2 area (a density of 31 per km^2). To our knowledge, this is the first such record of crab pot loss ever produced, and will form the basis for more research on the condition and contents of lost 'ghost pots' in spring of 1995 (see below).

Phase 2: Submersible Research:

After some loss of time to weather, we achieved 7 days of diving operations. In that time we made 37 dives, of which 6 were short demo dives for VIP's or students. Initial searches of site CRAB91 revealed no crabs within 500 m of that site. After 3 more days of searching, we finally located aggregated female Tanner crabs and mating pairs at a site (CRAB94) approx. 750 m SW of site CRAB91. Over the next 24 hrs, we observed and collected 10-15 female crabs per dive at 4 hr intervals, for a total of >100 crabs. The final two days were dedicated to running video transects across the seafloor to provide greater detail on the distribution and abundance of crabs. A one-day extension of the project (due to weather) allowed us to work through Wednesday, 27 April. Since the DGPS had worked so well for us during the Sonar survey, we extended our contract for that equipment, and placed it aboard the Cavalier. Positions obtained for the *Delta* using the DGPS were improved dramatically, to an accuracy of ±10 m.

Results to Date

We had originally intended to collect female crabs exhibiting different behaviors (buried, mounded, inside/outside of mounds) and to compare their reproductive conditions. However, our time with the *Delta* was up before aggregative activity had reached its peak, so all of the crabs we collected were those which were buried in the mud prior to forming mounds, and we were unable to collect "mounded" crabs. We saw numerous grasping pairs around and among the aggregated females, but made no attempt to collect them, as we had done in 1991.

All crabs collecting during diving operations were dissected later in the lab, and measurements were recorded for shell condition, clutch volume, ovary dry weight, stomach contents, and spermathecal contents weight. Shell conditions and clutch sizes were all uniform, and indicated that most female crabs were multiparous, and of advanced age. All crab stomachs were empty indicating that crabs do not feed during the mating period. Most crabs had no stored sperm (average weight of spermathecal contents was 0.046 g). Most crabs had large orange ovaries, indicating they would spawn again in 1994. Some crabs had abnormally small clutches; these usually also had very small ovaries, suggesting that they were senescent crab which would probably not spawn again. Average ovary weight was about 9 g.

An additional collection of 150 female crabs was made by trawl in October, 1994, from the same site. These females, which were 5 months post-spawning, were compared to the April (pre-spawning) collection; they were identical in size, but included about 2% primiparous crabs; clutch volume of newly extruded eggs was smaller (eggs expand as they develop); ovary weight was <5 g (as expected for recent spawners); many had food remains in their stomachs (average dry weight 0.18 g); surprisingly, weight of spermathecal contents was still extremely low, only about 0.054 g (compared to average weights of about 2.0 g for Bering Sea female Tanner crab).

These results suggest that female Tanner crab in the observed aggregation are of advanced age, and nearing reproductive senescence. In addition, the extremely low volume of stored sperm suggests that they either are fertilizing eggs with the last reserves of sperm from previous matings, or that they are just being mated once, and receiving barely enough sperm for a single clutch. Females in the Bering Sea, on the other hand, usually have large quantities (up to 4 g) of stored sperm, probably from multiple previous matings. These data imply that the ratio of males to females in Chiniak Bay may be too low for effective reproduction. Our previous observations of sex ratios in the range of 10 to 100 females per male support this conclusion. However, trawl survey data collected by the Alaska Dept. of Fish and Game from randomly selected areas of Chiniak Bay during June show sex ratios close to unity. These apparently paradoxical results suggest that, while ratios of adult males and females in Chiniak Bay may be nearly uniform, perhaps only a small portion of the available males participate in mating, such that sex ratios observed in the aggregation were highly skewed.

We collected approximately 80 hr of videotape from the dives, most of which have not yet been analyzed quantitatively. In October, NMFS acquired a computer based video analysis system which gives us the ability to record a wide variety of observations along with their video time codes. We are just now working out the methods of obtaining this kind of data and converting time codes to positions along dive transects. We hope to have all of our 1994 observations completed, and methods defined, prior to beginning our 1995 efforts.

The following discussion is therefore based more on qualitative observations. During the four days on which we observed crabs, we saw larger groups each day. On the first day, groups of 3-5 per m^2 were observed. On subsequent days we observed groups of 10-15, and 20-30. On the final dive, a group of >100 crabs was observed. This suggests that aggregation is a process by which crabs form into small groups first, which later coalesce into larger groups. We had expected to see more activity at night, as observed in 1992, but our night dives were conducted during the early stages of aggregation, and there was little activity at night, and no apparent diel difference in activity.

While searching a large area of Chiniak Bay, we encountered at least 9 crab pots. In fact, they were a hazard to navigation of the *Delta* because of the poor visibility. Virtually all of them contained fish, crabs, or both, despite some having large openings in the mesh. These observations imply that probably all the 'anthropogenic objects' observed by the sonar were crab pots, many of which were still fishing.

Conclusions

C. bairdi of both sexes were aggregated in Chiniak Bay for purposes of mating in 1994 as they had been in 1991, 92 and 93. However, the crabs had moved from the area where observed previously. One possible reason for this move is that the previous site (CRAB91) had received extensive fishwaste dumping about 3 weeks prior to our visit. At the time of our observations, only gray (fungal or bacterial?) mats of decomposing material remained, but they were extensive, covering hundreds of meters. This zone was devoid of crabs, but flounders were abundant there. An unusual observation made in this waste zone, were numbers of an unknown invertebrate worm which might be a sipunculid or echiurid. These 'worms' had never been observed during dives in previous years. They probably live below the sediment surface normally, but had come up to the surface either to avoid or consume the gray mats. Apparently, crabs do not like fish waste, and avoid zones where it was abundant.

Aggregation may be a short-lived event, perhaps only two to three weeks. Our dives in 1991 occurred over a 3 week period, so we were able to observe the full intensity of the event. In 1992 we arrived 1-2 weeks too late, and this year, about a week too early. Predicting the time of the event is a difficult process. Crabs had not begun to form aggregations when the sonar survey was conducted, thus explaining our inability to detect them. If the sonar had been used during the peak of aggregation, we are confident that mounds would have been detected. Nonetheless, it indicates that using sonar to locate aggregations would only be feasible during a short time window, and verifying the source of signals would be difficult without a camera. A camera on the bottom is the only accurate way to find crabs.

B. FUTURE RESEARCH NEEDS

Due to our inability to predict the timing of the aggregation accurately, we were unable to observe crabs during the mounding process, and were able to collect only about half of the females we wanted to examine. Nevertheless, we have now observed the process at three different stages (early, middle, and late) and sampled females from the early and late stages in 1994 and 1992, respectively. What remains is for us to observe and collect females during the peak of the aggregation. There are still many questions left to be answered, and which we believe could be answered by future NURP-sponsored research.

Although we do not know what controls the timing of the event, research by other scientists has shown that late stage phytoplankton cells can stimulate hatching the the congener C. opilio. If hatching is delayed until zooplankton populations are peaking, that would explain why hatching/mating appears to be a semi-synchronous event.

Our research plans for 1995 (which will be partially funded by NURP) are to observe crabs over a longer time period with the ROV. We also hope to have the *Delta* in place prior to the peak of aggregation, then to begin dives when aggregation is in full swing. Questions we hope to answer include:

What is the complete sequence of events related to aggregation?
How long does aggregation last?
Does the aggregation disperse suddenly or slowly as crabs leave it?
How many crabs participate in the aggregation? What is their sex ratio?
How many mounds are formed, and how many females per mound?
What is the make-up of females in the mounds?
What proportion of females are senescent or unable to spawn?
What proportion actually get remated?
How large an area does the aggregation cover?

These questions are directly relevant to management of crab fisheries in Alaska. As a result of our NURP-funded investigations, we have begun to totally redefine the understanding of reproduction of Tanner and snow crabs in particular, and of Majid crabs in general.

In addition to these questions, we will also direct some of our research efforts at determining whether lost crab pots are detrimental to crab populations. Using the pot map created in April 1994, we plan to do some inital pot recovery to test methods and record pot condition and contents. We also plan to spend up to 5 days of ROV time and 1-3 days of submersible time examining pot conditions and contents, using funding from the NOAA

Marine Debris Program, the ADFG, NMFS, and the U.S. Army Corps of Engineers. If we determine that pots are detrimental, or if we need more data on pot conditions, we will institute a second phase of large scale pot recovery in late 1995 or early 1996, during which we would attempt to recover >100 lost pots.

C. ADVANTAGES OF THE PROGRAM

The *Delta* is an excellent research tool, and has provided us with information and insights that would not be available with any other system. Although we strongly desire to begin working with ROV's which will allow us to maintain long term observation of the crabs at low cost, the *Delta* allowed us to observe and collect crabs exhibiting specific behaviors, so it is ideal for that purpose. The support we have received from the National Undersea Research Program has been instrumental in making our discoveries.

In addition to our planned research activities, this year we involved five students from Kodiak High School in our research program. All of them participated in collection of data and each was able to make a short dive in the *Delta*. This was an excellent opportunity for students to observe how marine biological research is conducted, and to participate in it first hand.

D. COMMENTS ON LOGISTICS AND OPERATIONS

As we had experienced previously, the *Delta* and crew performed exceptionally well. They had no trouble meeting any of our requests, and we had no mechanical problems with the *Delta*. Chris Ijames, Dave Slater, Jerry Brown, and Don Tondro all deserve credit for exceptional effort. The Cavalier was an excellent vessel to work on; its accomodations exceeded our expectations, and thanks are due to Captain Lincoln Gray and his crew. The 'Science Van' worked well, providing ample space for scientific work, and the 'video room' was highly used.

We did encounter numerous problems this year. The greatest problem was the weather, which cost us 5 of our 12 dive days. This was frustrating because the vessel ran into bad weather during 14-18 April, on the way to Kodiak, so did not arrive until 18 April, whereas weather in Kodiak during that period was good for diving. Over the next 9 days in Kodiak, we lost 2 additional days to weather.

We experienced many technical and electronic problems. Since the *Delta* arrived late, they made an effort to dive on the day of arrival. On our first dives, the Trakpoint did not work, neither did the video camera, the DGPS or the trakpoint plotter. After the *Delta* crew changed out all the parts that evening, the Trakpoint worked reliably for the rest of the cruise. The video camera was made functional on day 2. On day 3 we got the DGPS to function properly, after several phone calls to SAIC to obtain correct wiring instructions, after which it worked reliably and very accurately.

We again had intermittent problems with the external camera flash, but discovered we could make it function if certain external lights were turned on (!!??). More work on that by Chris Ijames improved its operation, so that it was firing 90% by the end of the cruise. The PISCES data recorder worked well, but the temperature was not calibrated.

Chris calibrated it on day 6, and it seemed to work after that, but the data got lost when it was downloaded at the end of the cruise, so at this time we have no temperature data.

Obtaining accurate, real-time position information continues to be a problem for the *Delta*. This is a very critical part of our research, as we spend a lot of time working in a small area where crab density gradients change rapidly over short distances, and we want to be able to position the *Delta* at certain locations repeatedly. We also make long transects to count organisms, and these have to be located accurately in order to obtain precise density estimates. The new FUSION system which was supposed to have been fixed while in Seattle was not working when it arrived in Kodiak. The designer (Jeff Hummel) did not show up to fix it until day 4 of our cruise, so we do not have continuous position data for the first 4 days. Even after he arrived and provided new software, it continued to have problems. The final data records that we received did not have any latitudes in them!!! After the cruise, I sent the data back to Jeff for 'repair'. When working, the system provides highly accurate positions in real time, so it is easy to track and steer the sub, and plot where you have been. I hope they can get all the bugs worked out this year, because this is a very necessary component. However, it is only as accurate as the navigation data. Without DGPS, the data would be only accurate to ± 100 m which is not good enough for repeat diving, whereas with DGPS, precision is ± 10 m. I highly recommend that scientists using the *Delta* should require a DGPS installation as part of their operations.

Data from the FUSION program and the PISCES were not made available to me until several hours before the *Delta* left Kodiak. As a result, I did not discover the problems with lost data until after the boat had left. These could have been prevented if I had been given the data to examine earlier in the cruise. I highly recommend that scientists be given example data files early in the cruise to check for such problems.

Throughout all of this, the *Delta* crew made a tremendous effort to fix problems as soon as possible, and to dive in as much weather as they felt safe. For this we owe them much appreciation.

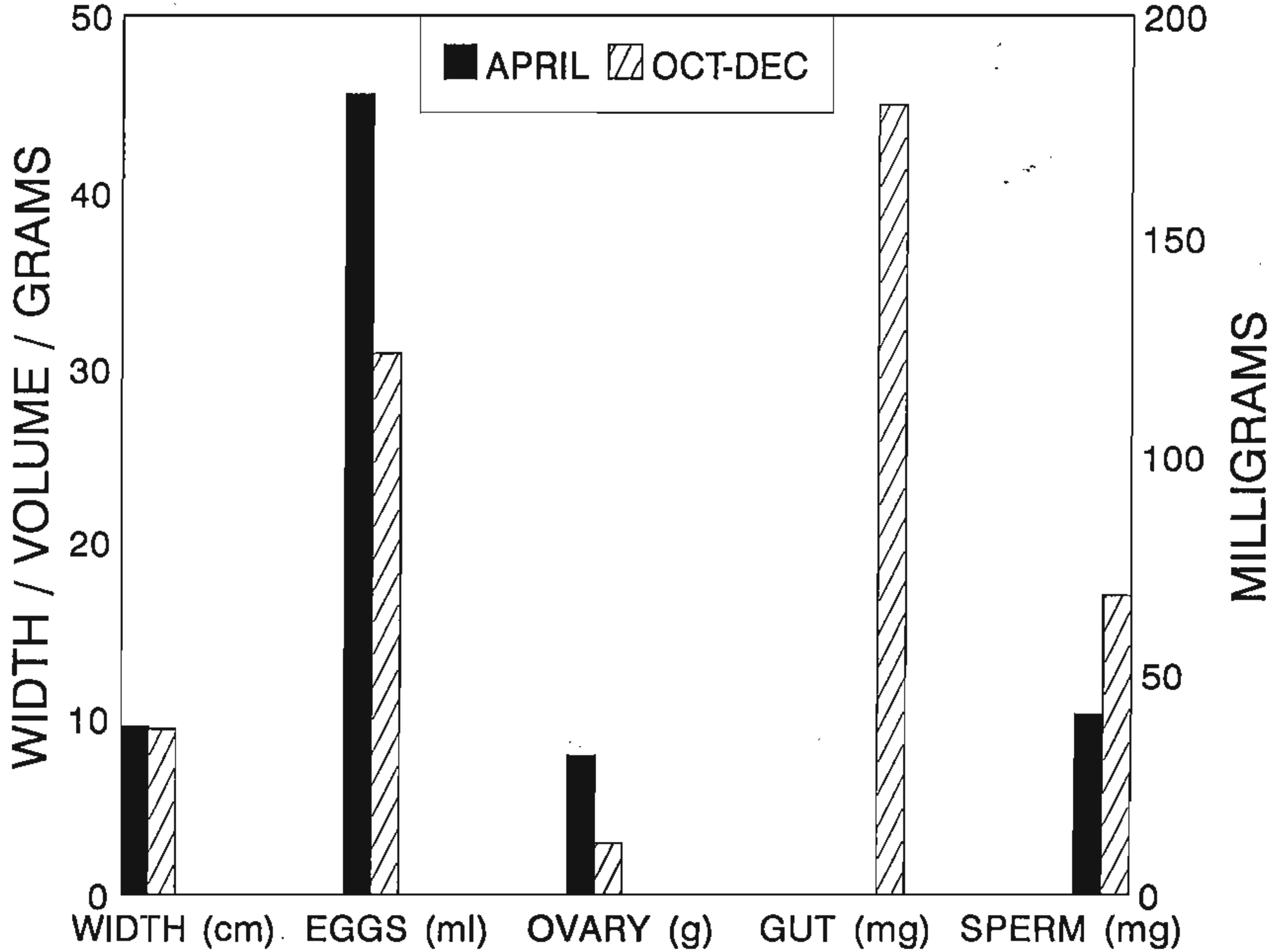
FEMALE TANNER CRABS

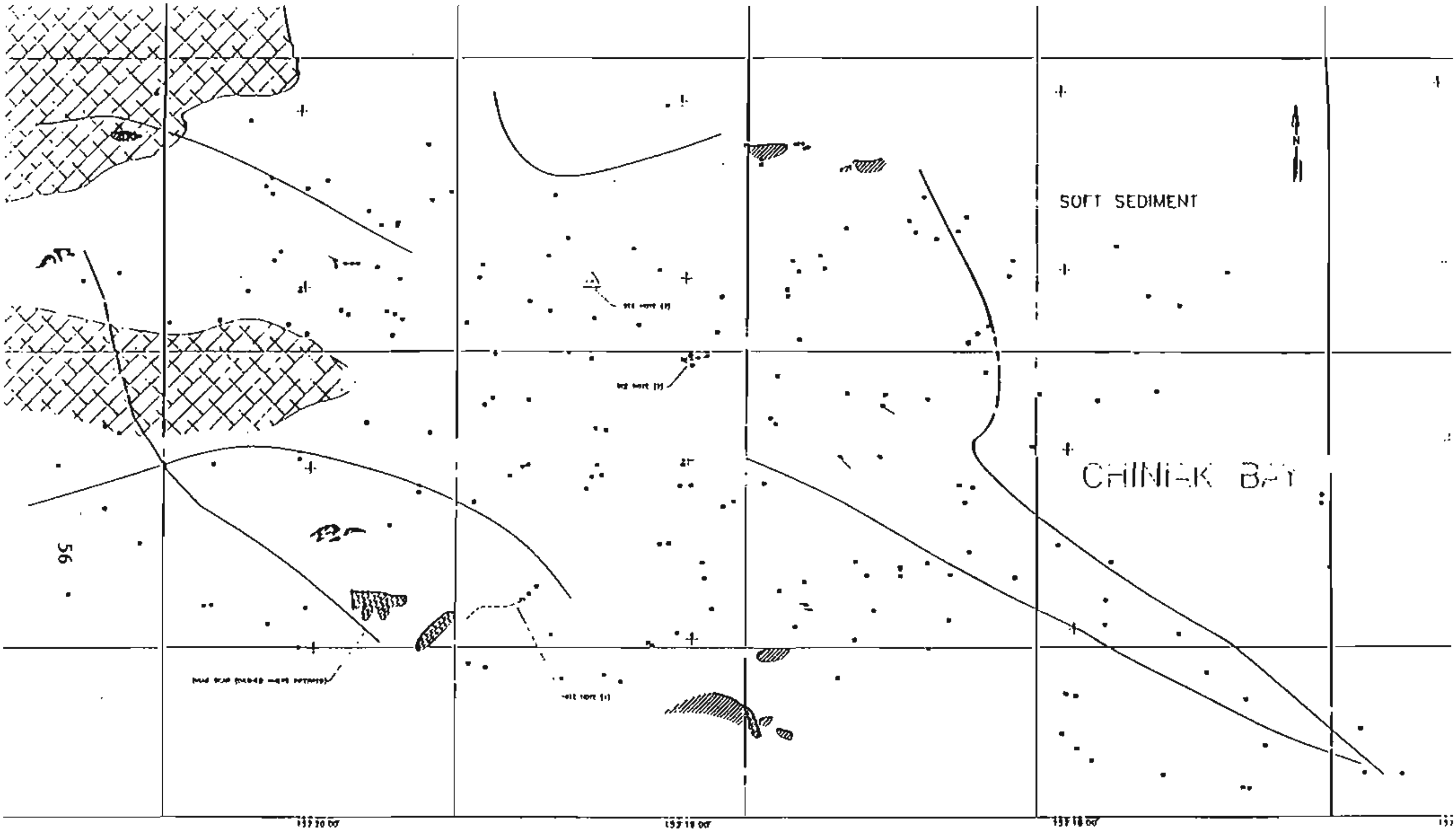
Collected for Reproductive Study

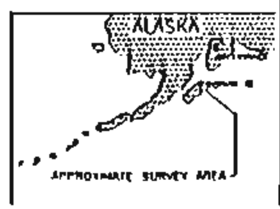
SITE: DATE	TOTAL	IMMATURE	PRIMIP	MULTIP
CHIN: APRIL	112	0	0	112
CHIN: OCT 4	145	15	3	126
WOM: NOV-DEC	10	3	3	4

CHIN = Chiniak Bay, WOM = Womens Bay

REPRODUCTIVE PARAMETERS FOR FEMALE TANNER CRAB







FEET

METERS

NAVIGATION INFORMATION	
NAVIGATION SYSTEM	[illegible]
DATUM	[illegible]
SPHEROID	[illegible]
PROJECTION	[illegible]
ZONE	[illegible]
UNITS	[illegible]
SURVEY DATE	[illegible]
VESSEL	[illegible]
DRAWN BY	[illegible]

SEAFLOOR FEATURES AS DETERMINED BY SIDE SCAN SONAR DURING THE 6, 7, AND 8 APRIL 1994

NATIONAL MARINE FISHERIES SE

KODIAK, AK

DRETSKA DEVELOPMENT SERVICES

Appendix B. 1. Enumerated pots, by location, identified on sidescan sonar

	Latitude				Longitude			
Pot #	Degrees	Minutes	Seconds	Decimal	Degrees	Minutes	Seconds	Decimal
1	57	43	19.10	57.7220	152	18	34.42	152.3096
2	57	43	16.75	57.7213	152	18	38.69	152.3107
3	57	43	15.48	57.7210	152	18	38.08	152.3106
4	57	43	16.33	57.7212	152	18	43.11	152.3120
5	57	43	15.42	57.7210	152	18	42.25	152.3117
6	57	43	13.87	57.7205	152	18	44.00	152.3122
7	57	43	13.27	57.7204	152	18	44.03	152.3122
8	57	43	9.88	57.7194	152	18	42.27	152.3117
9	57	43	8.98	57.7192	152	18	15.55	152.3043
10	57	43	9.80	57.7194	152	18	13.71	152.3038
11	57	43	10.33	57.7195	152	18	12.23	152.3034
12	57	43	14.43	57.7207	152	18	8.77	152.3024
13	57	43	15.86	57.7211	152	18	8.03	152.3022
14	57	43	19.69	57.7221	152	18	15.27	152.3042
15	57	43	18.68	57.7219	152	18	16.55	152.3046
16	57	43	17.95	57.7217	152	18	19.97	152.3055
17	57	43	18.41	57.7218	152	18	23.21	152.3064
18	57	43	19.56	57.7221	152	18	24.28	152.3067
19	57	43	21.40	57.7226	152	18	21.95	152.3061
20	57	43	17.03	57.7214	152	17	52.00	152.2978
21	57	43	12.46	57.7201	152	17	47.37	152.2965
22	57	43	11.91	57.7200	152	17	42.35	152.2951
23	57	43	14.45	57.7207	152	17	34.68	152.2930
24	57	42	49.52	57.7138	152	17	19.78	152.2888
25	57	42	55.02	57.7153	152	17	20.64	152.2891
26	57	42	55.85	57.7155	152	17	20.27	152.2890
27	57	42	44.38	57.7123	152	17	43.52	152.2954
28	57	42	45.37	57.7126	152	17	55.18	152.2987
29	57	42	47.17	57.7131	152	17	54.86	152.2986
30	57	42	50.47	57.7140	152	17	54.15	152.2984
31	57	42	52.09	57.7145	152	18	2.18	152.3006
32	57	43	7.73	57.7188	152	17	49.29	152.2970
33	57	43	4.63	57.7180	152	17	46.29	152.2962
34	57	43	3.90	57.7178	152	17	55.33	152.2987
35	57	43	4.68	57.7180	152	18	4.06	152.3011
36	57	43	0.37	57.7168	152	18	5.49	152.3015
37	57	42	49.23	57.7137	152	18	8.83	152.3025

(continued)

Appendix B. 1. (Page 2 of 5)

	Latitude				Longitude			
Pot #	Degrees	Minutes	Seconds	Decimal	Degrees	Minutes	Seconds	Decimal
38	57	43	6.65	57.7185	152	18	12.62	152.3035
39	57	42	57.52	57.7160	152	18	17.10	152.3048
40	57	42	57.31	57.7159	152	18	15.08	152.3042
41	57	42	55.94	57.7155	152	18	16.16	152.3045
42	57	42	51.43	57.7143	152	18	16.15	152.3045
43	57	42	45.94	57.7128	152	18	19.09	152.3053
44	57	42	49.66	57.7138	152	18	18.92	152.3053
45	57	42	50.62	57.7141	152	18	22.60	152.3063
46	57	42	50.79	57.7141	152	18	26.86	152.3075
47	57	42	49.77	57.7138	152	18	26.91	152.3075
48	57	42	51.00	57.7142	152	18	33.94	152.3094
49	57	42	49.84	57.7138	152	18	32.19	152.3089
50	57	42	47.06	57.7131	152	18	31.31	152.3087
51	57	42	44.75	57.7124	152	18	34.34	152.3095
52	57	42	45.96	57.7128	152	18	43.62	152.3121
53	57	42	48.71	57.7135	152	18	46.40	152.3129
54	57	42	49.62	57.7138	152	18	42.55	152.3118
55	57	43	15.88	57.7211	152	20	34.82	152.3430
56	57	43	16.71	57.7213	152	20	29.28	152.3415
57	57	43	31.85	57.7255	152	20	22.84	152.3397
58	57	43	12.40	57.7201	152	20	21.59	152.3393
59	57	43	12.42	57.7201	152	20	13.95	152.3372
60	57	43	14.83	57.7208	152	20	9.34	152.3359
61	57	43	29.31	57.7248	152	20	8.22	152.3356
62	57	43	24.33	57.7234	152	20	4.96	152.3347
63	57	43	23.86	57.7233	152	20	5.78	152.3349
64	57	43	23.06	57.7231	152	20	4.67	152.3346
65	57	43	17.88	57.7216	152	20	4.02	152.3345
66	57	43	17.41	57.7215	152	20	4.82	152.3347
67	57	43	11.22	57.7198	152	20	0.28	152.3334
68	57	43	11.97	57.7200	152	20	3.04	152.3342
69	57	43	14.65	57.7207	152	20	0.78	152.3336
70	57	43	23.65	57.7232	152	19	59.03	152.3331
71	57	43	24.03	57.7233	152	19	56.08	152.3322
72	57	43	12.63	57.7202	152	19	53.57	152.3315
73	57	43	12.88	57.7202	152	19	54.35	152.3318
74	57	43	16.86	57.7214	152	19	54.95	152.3319
75	57	43	17.08	57.7214	152	19	53.49	152.3315
76	57	43	17.13	57.7214	152	19	52.70	152.3313

(continued)

Appendix B. 1. (Page 3 of 5)

	Latitude				Longitude			
Pot #	Degrees	Minutes	Seconds	Decimal	Degrees	Minutes	Seconds	Decimal
77	57	43	17.00	57.7214	152	19	52.02	152.3311
78	57	43	10.92	57.7197	152	19	46.57	152.3296
79	57	43	12.04	57.7200	152	19	44.83	152.3291
80	57	43	12.41	57.7201	152	19	45.93	152.3294
81	57	43	12.91	57.7203	152	19	47.14	152.3298
82	57	43	15.40	57.7209	152	19	45.43	152.3293
83	57	43	21.43	57.7226	152	19	49.57	152.3304
84	57	43	20.32	57.7223	152	19	48.16	152.3300
85	57	43	19.98	57.7222	152	19	45.58	152.3293
86	57	43	20.46	57.7224	152	19	45.34	152.3293
87	57	43	22.37	57.7229	152	19	39.97	152.3278
88	57	43	22.82	57.7230	152	19	36.91	152.3269
89	57	43	26.77	57.7241	152	19	40.20	152.3278
90	57	43	11.97	57.7200	152	19	35.05	152.3264
91	57	43	15.55	57.7210	152	19	32.97	152.3258
92	57	43	16.51	57.7213	152	19	32.48	152.3257
93	57	43	22.31	57.7229	152	19	20.74	152.3224
94	57	43	18.79	57.7219	152	19	18.88	152.3219
95	57	43	17.26	57.7215	152	19	21.86	152.3227
96	57	43	13.39	57.7204	152	19	25.07	152.3236
97	57	43	12.58	57.7202	152	19	21.96	152.3228
98	57	43	12.00	57.7200	152	19	14.81	152.3208
99	57	43	11.24	57.7198	152	19	7.75	152.3188
100	57	43	10.48	57.7196	152	18	55.30	152.3154
101	57	43	13.36	57.7204	152	18	54.59	152.3152
102	57	43	15.83	57.7211	152	19	4.28	152.3179
103	57	43	17.63	57.7216	152	19	8.36	152.3190
104	57	43	29.70	57.7249	152	19	2.38	152.3173
105	57	43	24.51	57.7235	152	18	47.78	152.3133
106	57	43	4.19	57.7178	152	18	21.50	152.3060
107	57	43	5.00	57.7181	152	18	28.22	152.3078
108	57	43	3.93	57.7178	152	18	29.17	152.3081
109	57	42	59.73	57.7166	152	18	29.59	152.3082
110	57	42	59.75	57.7166	152	18	35.89	152.3100
111	57	43	5.20	57.7181	152	18	34.62	152.3096
112	57	43	6.57	57.7185	152	18	45.92	152.3128
113	57	43	3.21	57.7176	152	18	47.09	152.3131
114	57	43	2.66	57.7174	152	18	46.10	152.3128
115	57	42	57.99	57.7161	152	18	48.24	152.3134

(continued)

	Latitude				Longitude			
Pot #	Degrees	Minutes	Seconds	Decimal	Degrees	Minutes	Seconds	Decimal
116	57	43	8.46	57.7190	152	18	56.96	152.3158
117	57	43	8.67	57.7191	152	18	59.54	152.3165
118	57	43	8.14	57.7189	152	19	0.58	152.3168
119	57	43	8.23	57.7190	152	18	58.55	152.3163
120	57	43	7.89	57.7189	152	18	59.25	152.3165
121	57	42	56.55	57.7157	152	18	53.24	152.3148
122	57	42	59.37	57.7165	152	19	0.88	152.3169
123	57	42	57.80	57.7161	152	19	1.28	152.3170
124	57	42	57.90	57.7161	152	18	59.71	152.3166
125	57	42	55.92	57.7155	152	18	55.07	152.3153
126	57	42	52.93	57.7147	152	19	4.99	152.3181
127	57	42	52.91	57.7147	152	19	3.54	152.3177
128	57	42	51.21	57.7142	152	18	58.33	152.3162
129	57	42	50.18	57.7139	152	18	58.16	152.3162
130	57	42	47.70	57.7133	152	18	57.04	152.3158
131	57	42	45.66	57.7127	152	19	2.18	152.3173
132	57	42	44.52	57.7124	152	19	6.17	152.3184
133	57	42	44.71	57.7124	152	19	6.84	152.3186
134	57	42	45.70	57.7127	152	19	22.76	152.3230
135	57	42	49.76	57.7138	152	19	24.93	152.3236
136	57	42	49.24	57.7137	152	19	26.43	152.3240
137	57	42	48.53	57.7135	152	19	27.35	152.3243
138	57	43	8.46	57.7190	152	19	15.41	152.3209
139	57	43	8.99	57.7192	152	19	19.09	152.3220
140	57	43	9.09	57.7192	152	19	31.02	152.3253
141	57	43	4.84	57.7180	152	19	32.67	152.3257
142	57	43	5.30	57.7181	152	19	31.31	152.3254
143	57	43	2.68	57.7174	152	19	15.11	152.3209
144	57	43	2.48	57.7174	152	19	13.22	152.3203
145	57	42	59.12	57.7164	152	19	14.15	152.3206
146	57	42	59.90	57.7166	152	19	14.35	152.3207
147	57	42	58.90	57.7164	152	19	15.52	152.3210
148	57	42	57.95	57.7161	152	19	16.59	152.3213
149	57	42	59.99	57.7167	152	19	25.93	152.3239
150	57	42	59.65	57.7166	152	19	26.83	152.3241
151	57	42	58.83	57.7163	152	19	28.90	152.3247
152	57	42	56.93	57.7158	152	19	34.62	152.3263
153	57	43	2.48	57.7174	152	19	41.21	152.3281
154	57	42	57.93	57.7161	152	19	43.12	152.3286

(continued)

Appendix B. 1. (Page 5 of 5)

	Latitude				Longitude			
Pot #	Degrees	Minutes	Seconds	Decimal	Degrees	Minutes	Seconds	Decimal
155	57	42	55.05	57.7153	152	19	47.52	152.3299
156	57	43	3.63	57.7177	152	19	50.72	152.3308
157	57	43	0.78	57.7169	152	20	2.10	152.3339
158	57	43	0.78	57.7169	152	20	15.60	152.3377
159	57	42	48.65	57.7135	152	20	17.28	152.3381
160	57	42	48.81	57.7136	152	20	16.04	152.3378
161	57	42	47.18	57.7131	152	20	7.22	152.3353
162	57	42	48.44	57.7135	152	20	1.22	152.3337
163	57	43	3.25	57.7176	152	20	29.65	152.3416
164	57	43	3.81	57.7177	152	20	32.00	152.3422
165	57	43	0.73	57.7169	152	20	39.67	152.3444
166	57	42	56.97	57.7158	152	20	32.65	152.3424
167	57	42	53.95	57.7150	152	20	26.93	152.3408
168	57	42	50.25	57.7140	152	20	38.57	152.3440
169	57	42	43.22	57.7120	152	19	35.47	152.3265
170	57	42	42.95	57.7119	152	19	33.02	152.3258
171	57	42	41.77	57.7116	152	19	21.14	152.3225
172	57	42	42.16	57.7117	152	19	14.03	152.3206
173	57	42	41.52	57.7115	152	19	11.26	152.3198
174	57	42	41.37	57.7115	152	18	37.19	152.3103
175	57	42	43.70	57.7121	152	18	22.46	152.3062
176	57	42	39.62	57.7110	152	18	1.51	152.3004
177	57	42	39.54	57.7110	152	18	0.06	152.3000
178	57	42	36.27	57.7101	152	18	2.24	152.3006
179	57	42	35.22	57.7098	152	18	0.04	152.3000
180	57	42	34.16	57.7095	152	17	57.95	152.2994
181	57	42	32.69	57.7091	152	17	46.88	152.2964
182	57	42	41.01	57.7114	152	17	39.53	152.2943
183	57	42	38.83	57.7108	152	17	33.34	152.2926
184	57	42	35.06	57.7097	152	17	30.70	152.2919
185	57	42	31.48	57.7087	152	17	32.89	152.2925
186	57	42	31.56	57.7088	152	17	34.12	152.2928
187	57	42	36.24	57.7101	152	17	15.45	152.2876
188	57	42	32.75	57.7091	152	17	15.29	152.2876
189	57	42	32.42	57.7090	152	17	9.22	152.2859
190	57	42	37.32	57.7104	152	16	57.87	152.2827

Appendix C.1. Pot retrieval form used during the pilot study, 1995.

POT RETRIEVAL FORM (POTS)

Sheet ______ of ______

Pot Number ____________, Pot Location: Longitude ________________

Latitude ________________

Pot Type ________________

Pot Description:

General Condition Very Poor, Poor, Fair, Good, Excellent

Mesh Size(s): ________________________, Bios: Yes No

Dimension: ____

Tunnel Opening Size(s): ________________________________

Torn Webbing: Yes No

If "YES", size of openings

____

____

Number of Broken Side Frames: ____________________________

Number of Broken Corners: ____________________________

Bait Container: YES NO, Type: ____________________

If Bait still in container, How Full: ____________

Estimated Age (if possible): ________________________

Comments: ____

____

____

____

____

Instructions for the Pot Retrieval Form:

Pot Number: The number, as listed on the chart, of the pot which attempting to be retrieved.

Pot Location: Give the approximate location, as given by the ships navigational system.

Pot Type: Dungeness, King Crab, Tanner Crab, Shrimp, Cod or other.

Pot Description:

General Condition: Consider what it would take to re-use this pot. If all sides are broken, webbing is torn all over, and all welds are broken then it would be a "Very Poor", if a person could use it the next day in a fishery then it would be a "Excellent".

Mesh Size: Measure the mesh size from corner to corner, note if there are several mesh sizes and on number sides of the pot that size is on.

Bios: Are BIOdegradable enhancement on the pot

Dimension: Cubic or conical, then appropriate size i.e. Cubic 7 x 7 x 4 ft.

Tunnel Openings: How large are the tunnel openings, use standard measures or measure if unsure.

Torn Webbing: Approximate size of holes, i.e. 2 sq. ft.

Number of Broken Side Frames: List number of vertical and horizontal frame supports which have large cracks or are completely severed, i.e. 3 damaged supports. Also note if the breaks look recent (as caused from the retrieval) or older.

Number of Broken Corners: List number of welds, at the corners that have broken, also note if it is a recent or old break.

Bait Containers: If they are present are they metal or plastic and do they still contain bait.

Estimated Age: Estimate in general terms, i.e. < 1 year, > 5 years etc.

Comments: Make any comments which are deemed needed due to aspects not covered in this form (not dealing with catch information).

Appendix C.2. Pot retrieval form used during the directed and undirected studies, 1996.

POT RETRIEVAL FORM (POTS)

Date ________ Recorder ________

Time ________ Sheet ______of______

Pot Number ____________, Pot Location: Longitude______________

Depth (fm)______________

Latitude______________

Pot Type______________

Pot Description:

General Condition: Very Poor, Poor, Fair, Good, Excellent

Mesh Size(s):________________________, Bios: I D N

Pot Dimension:______________________________

Tunnel Opening Size(s):______________________________

Torn Webbing: Yes No

If "YES", size of openings

____

Number of Broken Side Frames:______________________________

Number of Broken Corners:______________________________

Bait Container: YES NO, Type:______________________________

If Bait still in container, How Full:______________

Estimated Age (if possible):______________________________

Comments: 1.In Pot ______________________________

____

____

2.Attached to Pot ______________________________

____

____

3.Additional Comments:______________________________

Instructions for the Pot Retrieval Form:

Pot Number: The number, as listed on the chart, of the pot.

Pot Location: Give the approximate location, as given by the ships navigational system.

Pot Type: Dungeness, King Crab, Tanner Crab, Shrimp, Cod or other.

Pot Description:

General Condition: Consider what it would take to re-use this pot. If all sides are broken, webbing is torn all over, and all welds are broken then it would be a "Very Poor", if a person could use it the next day in a fishery then it would be a "Excellent".

Mesh Size: Measure the mesh size from corner to corner, note if there are several mesh sizes and on number sides of the pot that size is on.

Bios: Are BIOdegradable enhancement on the pot; I=intact, D=degraded, N=No Bios

Dimension: Cubic or conical, then appropriate size i.e. Cubic 7 x 7 x 4 ft.

Tunnel Openings: How large are the tunnel openings, use standard measures or measure if unsure.

Torn Webbing: Approximate size of holes, i.e. 2 sq. ft.

Number of Broken Side Frames: List number of vertical and horizontal frame supports which have large cracks or are completely severed, i.e. 3 damaged supports. Also note if the breaks look recent (as caused from the retrieval) or older.

Number of Broken Corners: List number of welds, at the corners that have broken, also note if it is a recent or old break.

Bait Containers: If they are present are they metal or plastic and do they still contain bait.

Estimated Age: Estimate in general terms, i.e. < 1 year=new, >1 and <5=old, >5years =very old etc.

Comments: Make any comments which are deemed needed due to aspects not covered on this form. Identify and count organisms **INPOT** and **ATTACHED to POT**(measure all crab).

Appendix C.3. Crab measurement form.

ADF&G CRAB DATA FORM

Page ________ of ________

SPECIES ____________________

SEX ____________________

VESSEL

DATE

STATION NUMBER

POT ORDER

BUOY NUMBER

TRAWL HAUL NUMBER

SAMPLING FACTOR

	SPECIES	SEX CODE	CARAPACE LENGTH (MM)	CARAPACE WIDTH (MM)	SHELL	DISEASE CODE	EGGS: % CLUTCH FULLNESS	EGGS: DEVELOPMENT	EGGS: CLUTCH	COMMENTS
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										

CODE INSTRUCTIONS

SPECIES

1. *L. AEQUISPINA*
2. *P. CAMTSCHATICA*
3. *P.PLATYPUS*
6. *C.BAIRDI*
7. *C.OPILIO*
9. *C.MAGISTER*

SEX CODE

1. Sublegal Male
2. Legal Male
3. Juvenile Female
4. Adult Female

SHELL CONDITION

0. Soft
1. New
2. Old
3. Very Old

DISEASE CODE

1. Black Mat
2. Bitter Crab Syndrome
3. Nemertean Worms
4. Parasitic barnacle

EGG DEVELOPMENT

1. Uneyed eggs
2. eyed eggs

CLUTCH CONDITION

1. Dead Eggs Not Apparent
2. Dead Eggs < 20%
3. Dead Eggs > 20%
4. Barren with Clean "Silky" Setae
5. Barren with "Matted" setae, Empty empty Egg Cases

Appendix C.4. Fish measurement form.

ALASKA DEPARTMENT OF FISH AND GAME

p ____ of ____

FISH LENGTH FREQUENCY FORM

TRIP NO.

DATE		
MO.	DAY	YR.

VESSEL NAME: ______________

SPECIES NAME	HAUL NO.	SPECIE CODE	SEX	SIZE GROUP	FREQ.	SPECIES NAME	HAUL NO.	SPECIE CODE	SEX	SIZE GROUP	FREQ.

AK Plaice	106	big skate	94	English	108	longnose	95	redbanded	308	rougheye	307	starry fld.	142
AK skate	88	butter sole	109	flathead	103	P.cod	202	redstripe	324	sablefish	203	yellowfin	140
Aleut.skate	85	dover sole	107	halibut	101	POP	301	rex sole	105	sand sole	115		
arrowtooth	141	dusky rockfish	330	herring	611	pollock	201	rock sole	104	thornyhead	350		

Appendix D. 1.   Information on the pots recovered during the pilot study in 1995.

Pot #	Longitude	Latitude	Depth (m)	Condition	Min Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh Size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole size cm x cm	# of Broken Sides	# of Broken Corners	Type of Bait Jar	Bio-Twine
32	152.3028	57.7085	NR	Good	1	Conical	1.5 x 1.5	6.4 x 6.4	NR	N	NA	0	0	None	None
							(5' x 5')	(2.50"x 2.50")	NR		NA				
38	152.3045	57.7143	NR	Poor	2	Rect.	1.8 x 2.1 x 0.8	10.2 x 10.2	31 x 20	N	NA	0	0	Plastic	Intact
							(6' x 7' x 32")	(4.00"x 4.00")	(12" x 8")		NA				
112	152.3077	57.7178	144	Good	1	Conical	1.8	10.2 x 10.2	69	N	NA	0	0	Plastic	Intact
							(72")	(4.00"x 4.00")	(27")		NA				
143	152.3192	57.7172	NR	Good	2	Conical	1.5 x 0.8	7.6 x 10.2	46	Y	56 x 23	0	0	Plastic	None
							(59"x 30")	(3.00"x 4.00")	(18")		(22"x 9")				
145	152.3190	54.7098	NR	Fair	2	Rect.	2.0 x 2.0	10.2 x 10.2	122 x 91 x 20	N	NA	0	0	Plastic	Intact
							(6.5' x 6.5')	(4.00"x 4.00")	(4' x 36"x 8")		NA				
183	152.2900	57.7068	103	Very Poor	2	Conical	2.1	7.6 x 7.6	69	Y	41 x 20	2	0	Plastic	None
							(72")	(3.00"x 3.00")	(27")		(16"x 8")				
184	152.2900	57.7068	103	Good	1	Conical	2.4	7.6 x 7.6	NR	Y	15 x 8	0	0	Plastic	Intact
							(8')	(3.00"x 3.00")	NR		(6"x 3")				

NR stands for Not Recorded. This indicates that the information did not get recorded on the data form at the time the pot was retrieved.

Appendix D. 2.   Information on the pots recovered during the directed study in 1996.

Pot #	Longitude	Latitude	Depth (m)	Condition	Min. Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh Size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole Size cm x cm	# of Broken Sides	# of Broken Corners	Type of Bait Jar	Bio-Twine
7	152.3113	57.7170	150	Fair	3	Rect.	1.5 x 1.5 x 0.8	9.5 x 10.8	89 x 18	Y	46 x 23	0	0	Plastic	Degraded
							(5' x 5' x 32")	(3.75 x 4.25")	(35"x 7")		(18"x 9")				
11	152.2847	57.7177	82	Poor	3	Rect.	1.7 x 1.7 x 0.8	7.6 x 7.6	91 x 20	N	NA	0	0	Plastic	Degraded
							(67"x 67"x 32")	(3.00"x 3.00")	(36"x 8")		NA				
12	152.3067	57.7183	152	Poor	5	Rect.	2.1 x 2.1	7.6 x 7.6	89 x 18	Y	18 x 3	0	0	Plastic	None
							(7' x 7')	(3.00"x 3.00")	(35"x 7")		(7"x 1")				
15	152.3038	57.7245	155	Poor	5	Rect.	1.5 x 1.4 x 0.9	9.5 x 12.1	84 x 18	N	NA	0	0	None	None
							(59"x 57"x 34")	(3.75"x 4.75")	(33"x 7")		NA				
18	152.3148	57.7230	155	Fair	5	Rect.	2.1 x 2.1 x 0.9	11.4 x 11.4	91 x 20	Y	91 x 20	0	0	Plastic	None
							(7' x 7' x 34")	(4.50"x 4.50")	(36"x 8")		(36"x 8")				
42	152.3067	57.7183	152	Poor	5	Conical	1.3 x 0.6	6.4 x 11.4	36 x 36	N	NA	0	0	Plastic	None
							(51"x 25")	(2.50"x 4.50")	14"x 14")		NA				
48	152.3055	57.4292	140	Fair	3	Pyramid	2.1 x 1.2	9.5 x 10.2	46 x 46	N	NA	0	0	Plastic	None
							(84"x 47")	(3.75"x 4.00")	18"x 18")		NA				
57	152.3387	57.7267	154	Good	3	Pyramid	1.5 x 0.9 x 0.7	10.2 x 8.9	43	N	NA	0	0	Plastic	Degraded
							(5' x 3' x 28")	(4.00"x 3.50")	(17")		NA				
62	152.3332	57.7228	152	Fair	3	Conical	2.1 x 1.0	9.5 x 10.2	48	Y	48 x 20	0	0	Plastic	Degraded
							(82"x 41")	(3.75"x 4.00")	(19")		(19"x 8")				
65	152.3328	57.7207	162	Very Poor	5	Rect.	1.8 x 1.8 x 0.8	10.2 x 10.2	91 x 25	Y	18 x 15	0	0	Plastic	None
							(6' x 6' x 33")	(4.00"x 4.00")	36"x 10")		(7"x 6")				
68	152.3283	57.7177	158	Good	3	Conical	1.5 x 0.9 x 0.7	5.1 x 13.3	64	Y	43 x 25	0	0	Plastic	None
							(5' x 3')	(2.00"x 5.25")	(25")		(17"x 10")				
74	153.3243	57.7185	158	Poor	5	Rect.	1.8 x 1.8 x 0.8	8.9 x 12.1	74 x 20	N	NA	1	0	Plastic	None
							(6' x 6' x 30")	(3.50"x 4.75")	(29"x 8")		NA				
75	152.3243	57.7185	158	Poor	5	Conical	2.1 x 0.9	10.8 x 9.5	51	Y	33 x 25	0	0	None	None
							(7' x 3')	(4.25"x 3.75")	(20")		(13"x 10")				

(continued)

Appendix D. 2. (Page 2 of 4)

Pot #	Longitude	Latitude	Depth (m)	Condition	Min. Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh Size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole Size cm x cm	# of Broken Sides	# of Broken Corners	Type of Bait Jar	Bio-Twine
76	152.3362	57.7178	154	Excellent	3	Pyramid	2.0 x 1.1 x 0.6	9.5 x 9.5	46 x 46	N	NA	0	0	Plastic	Degraded
							(78"x 44"x 24")	(3.75"x 3.75")	18"x 18")		NA				
77	152.3362	57.7178	154	Excellent	3	Rect.	2.4 x 2.1 x 0.9	10.2 x 10.2	89 x 20	N	NA	0	0	None	Degraded
							(96"x 84"x 34")	(4.00"x 4.00")	(35"x 8")		NA				
79	152.3413	57.7233	165	Very Poor	5	Rect.	1.2 x no top	8.9 x 10.8	NR	Y	122 x 122	4	4	None	None
							(4' x no top)	(3.50"x 4.25")	NR		(4'x 4')				
80	152.3407	57.7297	144	Poor	5	Pyramid	1.8 x 1.1 x 0.7	NR	46 x 25	Y	25 x 20	0	1	None	None
							(72"x 44"x 26")	NR	18"x 10")		(10"x 8")				
85	152.3342	57.7265	76	Fair	3	Rect.	1.5 x 1.5 x 0.8	10.2 x 8.3	91 x 20	Y	38 x 23	0	0	Plastic	Degraded
							(60"x 60"x 32")	(4.00"x 3.25")	(36"x 8")		(15"x 9")				
88	152.3253	57.7197	156	Fair	5	Rect.	2.0 x 2.0 x 0.8	NR	NR	N	NA	0	0	None	NR
							(6.5' x 6.5' x 33")	NR	NR		NA				
89	152.3112	57.7228	154	Fair	3	Rect.	1.8 x 1.8 x 0.9	7.6 x 10.2	89 x 20	N	NA	0	0	Plastic	None
							(6' x 6' x 36")	(3.00"x 4.00")	(35"x 8")		NA				
91	152.3318	57.7237	163	Good	3	Rect.	1.8 x 1.8 x 0.8	10.8 x 9.5	89 x 20	Y	53 x 23	0	0	Plastic	Degraded
							(6' x 6' x 32")	(4.25"x 3.75")	(35"x 8")		(21"x 9")				
92	152.3273	57.7195	161	Fair	3	Rect.	1.7 x 1.7 x 0.9	9.5 x 10.8	86 x 20	N	NA	0	0	Plastic	None
							(5.5' x 5.5' x 34")	(3.75 x 4.25")	(34"x 8")		NA				
93	152.2393	57.7192	160	Fair	5	Rect.	1.8 x 1.8 x 0.8	10.2 x 12.7	84 x 25	N	NA	0	0	Plastic	None
							(6' x 6' x 31")	(4.00"x 5.00")	33"x 10")		NA				
94	152.3257	57.7248	158	Fair	3	Rect.	1.8 x 1.8 x 0.8	10.2 x 10.2	84 x 20	Y	48 x 15	0	0	Plastic	Degraded
							(6' x 6' x 31")	(4.00"x 4.00")	(36"x 8")		(19"x 6")				
95	152.3170	57.7220	158	Very Poor	5	Rect.	2.0 x 2.0 x 0.8	12.1 x 12.1	86 x 20	Y	76 x 38	4	1	Plastic	None
							(6.5' x 6.5' x 32")	(4.75"x 4.75")	(34"x 8")		(30"x 15")				
97	152.3270	57.7195	160	Very Poor	3	Cone	(1.7 x 1.2) x 0.8	9.5 x 6.4	38	Y	31 x 20	2	4	Plastic	None
							((68"x 48") x 31")	(3.75"x 2.50")	(15")		(12"x 8")				

(continued)

Appendix D. 2. (Page 3 of 4)

Pot #	Longitude	Latitude	Depth (m)	Condition	Min. Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh Size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole Size cm x cm	# of Broken Sides	# of Broken Corners	Type of Bait Jar	Bio-Twine
100	152.3135	57.7203	155	Fair	5	Rect.	1.8 x 1.8 x 0.9	10.8 x 10.2	79 x 20	Y	36 x 18	0	0	Plastic	None
							(6' x 6' x 34")	(4.25"x 4.00")	(31"x 8")		(14"x 7")				
108	152.3198	57.7208	158	Very Poor	3	Conical	1.0 x 0.6	8.3 x 3.2	38	Y	56 x 25	1	0	Plastic	None
							(40"x 24")	(3.25"x 1.25")	(15")		(22"x 10")				
111	152.3198	57.7208	158	Fair	5	Rect.	2.1 x 2.1 x 0.9	9.5 x 9.5	84 x 20	N	NA	0	0	Plastic	Degraded
							(84"x 84"x 35")	(3.75"x 3.75")	(36"x 8")		NA				
112	152.3135	57.7203	155	Good	3	Pyramid	1.9 x 0.8	8.9 x 10.8	46	N	NA	0	0	Plastic	None
							(74"x 30")	(3.50"x 4.25")	(18")		NA				
114	152.3142	57.7192	76	Fair	3	Cod	1.5 x 1.5	10.2 x 10.2	84 x 20	N	NA	0	0	Plastic	Degraded
							(5' x 5')	(4.00"x 4.00")	(36"x 8")		NA				
116	152.3335	57.7237	164	Poor	4	Pyramid	1.2 x 0.5	3.8 x 7.6	28 x 25	Y	23 x 10	0	0	Plastic	None
							(48"x 19")	(1.50"x 3.00")	11"x 10")		(9"x 4")				
117	152.3335	57.7237	164	Poor	5	Pyramid	1.2 x 0.5	3.8 x 7.6	28 x 25	Y	46 x 28	1	0	Plastic	None
							(48"x 19")	(1.50"x 3.00")	11"x 10")		(18"x 11")				
118	152.3335	57.7237	164	Poor	5	Rect.	1.8 x 1.8 x 0.8	8.3 x 10.8	89 x 25	Y	NR	0	0	Plastic	None
							(6' x 6' x 31")	(3.25"x 4.25")	35"x 10")		NR				
119	152.3335	57.7237	164	Fair	5	Rect.	2.0 x 2.0 x 0.8	9.5 x 10.8	89 x 20	Y	36 x 25	0	0	Plastic	Degraded
							(6.5' x 6.5' x 32")	(3.75 x 4.25")	(35"x 8")		(14"x10")				
120	152.3335	57.7237	164	Poor	5	Pyramid	1.4 x 1.0	5.7 x 7.0	61 x 18	Y	76 x 23	0	0	None	None
							(54"x 39")	(2.25"x 2.75")	(24"x 7")		(30"x 9")				
133	152.3225	57.7150	149	Poor	3	Conical	2.2 x 1.2	4.4 x 7.6	33	N	NA	0	0	Plastic	Degraded
							(86"x 49")	(1.75"x 3.00")	(13")		NA				
142	152.3342	57.7202	164	Very Poor	5	Rect.	2.3 x 2.3	10.2 x 11.4	81 x 20	Y	51 x 23	1	0	Plastic	None
							(7.5' x 7.5')	(4.00"x 4.50")	(32"x 8")		(20"x 9")				

(continued)

Appendix D. 2. (Page 4 of 4)

Pot #	Longitude	Latitude	Depth (m)	Condition	Min. Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh Size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole Size cm x cm	# of Broken Sides	# of Broken Corners	Type of Bait Jar	Bio-Twine
143	152.3263	57.7147	147	Good	5	Rect.	1.5 x 1.5 x 0.9	8.3 x 10.2	76 x 20	N	NA	0	0	Plastic	None
							(5' x 5' x 36")	(3.25"x 4.00")	(30"x 8")		NA				
145	152.3232	57.7162	152	Fair	5	Rect.	2.0 x 2.0 x 0.9	10.8 x 8.9	86 x 15	Y	130 x 3	0	0	Plastic	None
							(6.5' x 6.5' x 34")	(4.25"x 3.50")	(34"x 6")		(51"x 1")				
149	152.3225	57.7158	151	Very Poor	5	Conical	1.3 x 0.8	8.3 x 7.0	38	Y	23 x 13	4	0	Plastic	None
							(52"x 30")	(3.75"x 2.75")	(15")		(9"x 5")				
156	152.3457	57.7220	152	Very Poor	5	Rect.	1.8 x 1.8	5.1 x 6.4	NR	Y	NR	12	12	Plastic	NR
							(6' x 6')	(2.00"x 2.50")	NR		NR				
172	152.3180	57.7132	145	Fair	5	Rect.	1.8 x 1.8 x 0.8	11.4 x 10.2	91 x 25	Y	51 x 15	0	0	Nylon	Degraded
							(6' x 6' x 31")	(4.50"x 4.00")	36"x 10")		(20"x 6")				

NR stands for Not Recorded. This indicates that the information did not get recorded on the data form at the time the pot was retrieved.

Appendix D. 3. Information on the pots recovered during the undirected study in 1996.

Pot #	Longitude	Latitude	Depth (m)	Condition	Min. Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole Size cm x cm	# of Broken Sides	# of Broken Corners	Type of Bait Jar	Bio-Twine
1001	152.3298	57.7265	161	Good	1	Pyramid	2.1 x 1.2	10.2 x 8.9	46 x 46	N	NA	0	0	Plastic	None
							(83"x 4')	(4.00"x 3.50")	(18"x 18")		NA				
1002	152.4415	57.7667	13	Very Poor	5	Conical	1.4 x 0.4	6.4 x 6.4	43 x 43	N	NA	1	0	None	Degraded
							(55"x 17")	(2.50"x 2.50")	(17"x 17")		NA				
1003	152.4347	57.7648	15	Very Poor	5	Pyramid	1.5 x 1.2 x 0.6	11.4 x 11.4	41	Y	61 x 41	0	0	None	None
							(4' x 2')	(4.50"x 4.50")	(16")		(24"x 16")				
1004	152.4435	57.7665	14	NR	3	Rect.	1.8 x 1.8 x 0.8	11.4 x 11.4	91 x 20	Y	91 x 30	0	0	None	None
							(6' x 6' x 31")	(4.50"x 4.50")	(36"x 8")		(36"x 12")				
1005	152.4342	57.7615	15	Fair	3	Pyramid	1.1 x 0.7	7.0 x 7.0	25 x 25	N	NA	0	0	Plastic	None
							(44"x 26")	(2.75"x 2.75")	(10"x 10")		NA				
1006	152.4367	57.7795	14	Very Poor	5	Conical	1.3 x 0.5	8.9 x 8.9	46	Y	51 x 25	4	0	Plastic	None
							(50"x 18")	(3.50"x 3.50")	(18")		(20"x 10")				
1007	152.3275	57.7230	82	Good	0	Pyramid	1.5 x 1.0 x 0.7	8.9 x 7.6	53	N	NA	0	0	Plastic	Intact
							(59"x 36"x 27")	(3.50"x 3.00")	(21")		NA				
1008	152.3362	57.7178	154	Good	0	Cod	1.8 x 1.8 x 0.9	11.4 x 11.4	61 x 20	N	NA	1	0	Plastic	Degraded
							(70"x 70"x 34")	(4.50"x 4.50")	(24"x 8")		NA				
2001	152.4347	57.7700	13	Good	5	Rect.	1.8 x 1.8	10.2 x 10.2	91 x 18	Y	41 x 20	0	0	None	None
							(6' x 6')	(4.00" x 4.00")	(36"x 7")		(16"x 8")				
2002	152.4433	57.7662	13	Poor	5	Conical	1.2 x 0.6	6.4 x 6.4	61	Y	122 x 122	2	2	Plastic	None
							(4' x 2')	(2.50"x 2.50")	(24")		(48"x 48")				
2003	152.4433	57.7662	13	Fair	3	Round	0.9	7.6 x 7.6	25 x 10	Y	15 x 10	2	0	Plastic	None
							(36")	(3.00"x 3.00")	(10"x 4")		(6"x 4")				
2004	152.4368	57.7672	13	NR	3	Round	0.9	7.6 x 7.6	25 x 10	Y	61 x 30	0	0	Plastic	None
							(36")	(3.00"x 3.00")	(10"x 4")		(24"x 12")				

(continued)

Appendix D. 3. (Page 2 of 8)

Pot #	Longitude	Latitude	Depth (m)	Condition	Min. Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole Size cm x cm	# of Broken Sides	# of Broken Corners	Type of Bait Jar	Bio-Twine
2005	152.4443	57.7682	13	Good	3	Round	0.9	5.1 x 5.1	25 x 10	N	NA	0	0	Steel	None
							(36")	(2.00"x 2.00")	(10"x 4")		NA				
2006	152.3748	57.6502	73	Fair	3	Pyramid	2.1 x 2.1 x 0.6	10.2 x 10.2	41 x 41	N	NA	0	0	Plastic	None
							(7' x 7' x 2')	(4.00" x 4.00")	(16"x 16")		NA				
2007	152.4135	57.6390	49	Very Poor	5	Pyramid	2.0 x 2.0 x 0.6	10.2 x 10.2	41 x 41	Y	46 x 25	2	0	Plastic	None
							(6.5' x 6.5' x 24")	(4.00" x 4.00")	(16"x 16")		(18"x 10")				
2008	152.3873	57.6407	66	Fair	3	Pyramid	2.1 x 2.1 x 0.6	10.2 x 10.2	41 x 41	Y	30 x 15	0	0	Plastic	None
							(7' x 7' x 2')	(4.00" x 4.00")	(16"x 16")		(12"x 6")				
2009	152.4100	57.6392	43	Good	3	Pyramid	1.5 x 1.5 x 0.3	7.6 x 7.6	31 x 31	Y	NR	0	1	Plastic	None
							(5' x 5' x 12")	(3.00"x 3.00")	(12"x 12")		NR				
2010	152.4023	57.6280	68	Very Poor	5	Pyramid	1.8 x 1.8 x 0.5	10.2 x 10.2	31 x 31	Y	183 x 91	2	3	Plastic	None
							(6' x 6' x 18")	(4.00" x 4.00")	(12"x 12")		(72"x 36")				
2011	152.4252	57.6218	44	Fair	3	Rect.	1.8 x 1.8	7.6 x 7.6	81 x 18	N	NA	0	0	Plastic	None
							(6' x 6')	(3.00"x 3.00")	(32"x 7")		NA				
2012	152.4253	57.6198	46	Fair	5	Pyramid	1.2 x 1.2 x 0.3	5.1 x 5.1	25 x 25	Y	30 x 10	0	0	Plastic	None
							(4' x 4' x 12")	(2.00"x 2.00")	(10"x 10")		(12"x 4")				
2013	152.4195	57.6188	39	Fair	3	Round	0.9	7.6 x 7.6	25 x 10	N	NA	1	0	Plastic	None
							(36")	(3.00"x 3.00")	(10"x 4")		NA				
2014	152.4067	57.6392	59	Very Poor	5	Rect.	1.8 x 1.8	8.9 x 8.9	91 x 18	Y	61 x 30	2	3	Plastic	None
							(6' x 6')	(3.50"x 3.50")	(36"x 7")		(24"x 12")				
2015	152.3810	57.6415	61	Poor	5	Rect.	1.5 x 1.5	10.2 x 10.2	91 x 18	Y	30 x 10	0	1	Plastic	None
							(5' x 5')	(4.00" x 4.00")	(36"x 7")		(12"x 4")				
2016	152.3407	57.6670	80	Poor	5	Rect.	2.0 x 2.0	7.6 x 7.6	91 x 18	Y	41 x 20	1	1	Plastic	None
							(6.5' x 6.5')	(3.00"x 3.00")	(36"x 7")		(16"x 8")				

(continued)

Pot #	Longitude	Latitude	Depth (m)	Condition	Min. Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole Size cm x cm	# of Broken Sides	Corners	Type of Bait Jar	Bio-Twine
2017	152.3568	57.6583	60	Fair	3	Rect.	1.8 x 1.8 (6' x 6')	10.2 x 10.2 (4.00" x 4.00")	91 x 18 (36"x 7")	Y	30 x 10 (12"x 4")	0	2	Plastic	None
2018	152.3608	57.6540	49	Poor	5	Pyramid	1.8 x 0.6 x 0.4 (6' x 2' x 16")	10.2 x 10.2 (4.00" x 4.00")	41 x 41 (16"x 16")	Y	25 x 13 (10"x 5")	0	0	Plastic	None
2019	152.3588	57.6532	61	Fair	3	Rect.	1.8 x 1.8 (6' x 6')	8.9 x 8.9 (3.50"x 3.50")	91 x 18 (36"x 7")	Y	41 x 10 (16"x 4")	1	2	Plastic	None
2020	152.3605	57.6548	48	Good	3	Conical	1.5 x 0.6 (5' x 2')	6.4 x 6.4 (2.50"x 2.50")	40.6 (16")	Y	30 x 5 (12"x 2")	0	0	Plastic	Degraded
2021	152.3533	57.6638	66	Poor	5	Rect.	2.0 x 2.0 (6.5' x 6.5')	8.9 x 8.9 (3.50"x 3.50")	91 x 18 (36"x 7")	Y	51 x 46 (20"x 18")	2	2	Plastic	None
2022	152.3855	57.6537	71	Good	2	Rect.	1.8 x 1.8 (6' x 6')	8.9 x 8.9 (3.50"x 3.50")	91 x 18 (36"x 7")	Y	15 x 15 (6"x 6")	0	0	Bag	Degraded
2023	152.4063	57.6455	66	NR	3	Conical	2.1 x 0.6 (7' x 2')	10.2 x 10.2 (4.00" x 4.00")	40.6 (16")	Y	41 x 10 (L9816"x 4")	0	0	Plastic	None
2024	152.4272	57.6148	39	Fair	3	Round	0.9 (36")	5.1 x 5.1 (2.00"x 2.00")	25 x 10 (10"x 4")	N	NA NA	1	0	Plastic	None
2025	152.4215	57.6128	37	Good	3	Round	0.9 (36")	5.1 x 5.1 (2.00"x 2.00")	25 x 10 (10"x 4")	N	NA NA	0	0	Plastic	None
2026	152.4062	57.6313	53	NR	3	Pyramid	2.1 x 0.6 (7' x 2')	8.9 x 8.9 (3.50"x 3.50")	41 x 41 (16"x 16")	Y	46 x 10 (18"x 4")	0	0	None	Intact
2027	152.4075	57.6310	44	Poor	1	Rect.	1.8 x 1.8 (6' x 6')	10.2 x 10.2 (4.00" x 4.00")	91 x 18 (36"x 7")	Y	30 x 10 (12"x 4")	0	0	None	None
2028	152.3892	57.6365	39	Poor	5	Pyramid	2.1 x 0.6 (7' x 2')	10.2 x 10.2 (4.00" x 4.00")	41 x 41 (16"x 16")	Y	46 x 10 (18"x 4")	0	0	Plastic	None

(continued)

Pot #	Longitude	Latitude	Depth (m)	Condition	Min. Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole Size cm x cm	# of Broken Sides	Corners	Type of Bait Jar	Bio-Twine
2029	152.3490	57.6597	79	Fair	3	Pyramid	1.8 x 0.6	10.2 x 10.2	41 x 41	Y	30 x 10	0	0	Plastic	None
							(6' x 2')	(4.00" x 4.00")	(16"x 16")		(12"x 4")				
2030	152.3695	57.6600	74	Good	2	Conical	2.1 x 0.6	10.2 x 10.2	41 x 41	Y	20 x 10	0	0	Plastic	None
							(7' x 2')	(4.00" x 4.00")	(16"x 16")		(8" x 4")				
2031	152.3622	57.6662	81	Poor	6	Pyramid	2.1 x 0.6	8.9 x 8.9	41 x 41	Y	41 x 8	1	1	Plastic	None
							(7' x 2')	(3.50"x 3.50")	(16"x 16")		(16"x 3")				
2032	152.3487	57.6605	82	Fair	5	Rect.	1.8 x 1.8	10.2 x 10.2	91 x 18	Y	46 x 5	1	2	Plastic	None
							(6' x 6')	(4.00" x 4.00")	(36"x 7")		(18"x 2")				
2033	152.4025	57.6428	75	Fair	3	Conical	1.8 x 0.6	10.2 x 10.2	31	Y	41 x 10	0	0	Plastic	None
							(6' x 2')	(4.00" x 4.00")	(12")		(16"x 4")				
2034	152.4095	57.6325	61	NR	3	Pyramid	2.1 x 0.6	10.2 x 10.2	41 x 41	Y	46 x 30	0	0	Plastic	None
							(7' x 2')	(4.00" x 4.00")	(16"x 16")		(18"x 12")				
2035	152.3815	57.6452	70	Fair	3	Pyramid	1.5 x 0.4	10.2 x 10.2	31	N	NA	0	0	Plastic	None
							(16"x 5')	(4.00" x 4.00")	(12")		NA				
2036	152.3190	57.7047	105	Good	5	Pyramid	1.8 x 0.6	8.9 x 8.9	31 x 31	Y	25 x 10	0	0	Plastic	None
							(6' x 2')	(3.50"x 3.50")	(12"x 12")		(10"x 4")				
2037	152.3313	57.7047	80	Fair	3	Rect.	1.8 x 1.8	8.9 x 8.9	91 x 18	Y	30 x 10	1	2	Plastic	Degraded
							(6' x 6')	(3.50"x 3.50")	(36"x 7")		(12"x 4")				
2038	152.3203	57.7057	111	Poor	5	Rect.	2.1 x 2.1	8.9 x 8.9	91 x 18	Y	61 x 46	2	3	Plastic	None
							(7' x 7')	(3.50"x 3.50")	(36"x 7")		(L12824"x 18")				
2039	152.3130	57.7072	131	Fair	5	Rect.	1.8 x 1.8	10.2 x 10.2	91 x 18	Y	30 x 25	1	2	Plastic	None
							(6' x 6')	(4.00" x 4.00")	(36"x 7")		(12"x 10")				
2040	152.3178	57.6993	97	Fair	5	Pyramid	2.1 x 2.1	10.2 x 10.2	41 x 41	Y	41 x 10	0	1	Plastic	None
							(7' x 7')	(4.00" x 4.00")	(16"x 16")		(16"x 4")				

(continued)

Appendix D. 3. (Page 5 of 8)

Pot #	Longitude	Latitude	Depth (m)	Condition	Min. Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole Size cm x cm	# of Broken Sides	Corners	Type of Bait Jar	Bio-Twine
2041	152.3740	57.7173	89	Fair	3	Rect.	2.0 x 2.0	8.9 x 8.9	91 x 18	Y	30 x 18	1	0	Plastic	None
							(6.5' x 6.5')	(3.50"x 3.50")	(36"x 7")		(12"x 7")				
2042	152.3563	57.7182	117	Fair	3	Rect.	1.8 x 1.8	10.2 x 10.2	91 x 18	Y	30 x 25	1	1	Plastic	Degraded
							(6' x 6')	(4.00" x 4.00")	(36"x 7")		(12"x 10")				
2043	152.3552	57.7220	126	Poor	5	Rect.	1.5 x 1.5	10.2 x 10.2	91 x 18	Y	NR	2	0	Plastic	None
							(5' x 5')	(4.00" x 4.00")	(36"x 7")		NR				
2044	152.3587	57.7238	124	Poor	3	Rect.	1.5 x 1.5	10.2 x 10.2	91 x 18	Y	61 x 46	1	0	Plastic	None
							(5' x 5')	(4.00" x 4.00")	(36"x 7")		(24"x 18")				
2045	152.3618	57.7202	111	Fair	3	Rect.	1.8 x 1.8	10.2 x 10.2	91 x 18	Y	25 x 10	0	2	Plastic	Degraded
							(6' x 6')	(4.00" x 4.00")	(36"x 7")		(10"x 4")				
2046	152.6185	57.4320	95	Poor	3	Rect.	1.5 x 1.5 x0.8	12.7 x 12.7	84 x 20	N	NA	0	0	Plastic	None
							(60"x 60"x 32")	(5.00"x 5.00")	(33"x 8")		NA				
2047	152.6755	57.4233	79	Poor	3	Rect.	1.5 x 1.5 x 0.8	10.2 x 10.2	81 x 20	N	NA	0	0	None	Degraded
							(5' x 5' x 33")	(4.00" x 4.00")	(32"x 8")		NA				
2048	152.6782	57.4370	97	Poor	3	Rect.	1.8 x 1.8 x 0.8	10.2 x 10.2	71 x 20	N	NA	0	0	Plastic	Degraded
							(6' x 6' x 32")	(4.00" x 4.00")	(28"x 8")		NA				
2049	152.2620	57.7320	136	Fair	3	Conical	1.2 x 0.6	8.9 x 8.9	41	N	NA	4	4	None	None
							(4' x 2')	(3.50"x 3.50")	(16")		NA				
2050	152.2985	57.7068	142	Fair	5	Rect.	1.8 x 1.8	8.9 x 8.9	91 x 18	Y	30 x 20	1	2	Plastic	None
							(6' x 6')	(3.50"x 3.50")	(36"x 7")		(12"x 8")				
2051	152.3308	57.7250	163	Very Poor	5	Rect.	2.0 x 2.0	8.9 x 8.9	91 x 18	Y	183 x 46	3	3	None	None
							(6.5' x 6.5')	(3.50"x 3.50")	(36"x 7")		(72"x 18")				
2052	152.3690	57.7315	93	Fair	3	Rect.	1.8 x 1.8	12.7 x 12.7	91 x 23	Y	25 x 15	0	1	Plastic	None
							(6' x 6')	(5.00"x 5.00")	(36"x 9")		(10"x 6")				

(continued)

Appendix D. 3. (Page 6 of 8)

Pot #	Longitude	Latitude	Depth (m)	Condition	Min. Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole Size cm x cm	# of Broken Sides	# of Broken Corners	Type of Bait Jar	Bio-Twine
2053	152.2377	57.6930	46	Fair	3	Rect.	1.5 x 1.5	8.9 x 8.9	91 x 18	Y	51 x 15	0	1	Plastic	None
							(5' x 5')	(3.50"x 3.50")	(36"x 7")		(20"x 6")				
2054	152.2372	57.6778	48	Good	3	Pyramid	1.5 x 0.9	8.9 x 8.9	61	Y	20 x 15	0	0	Plastic	None
							(5' x 3')	(3.50"x 3.50")	(24")		(8" x 6")				
2055	152.1277	57.6978	163	Good	3	Rect.	2.0 x 2.0	8.9 x 8.9	91 x 18	N	NA	0	1	Plastic	None
							(6.5' x 6.5')	(3.50"x 3.50")	(36"x 7")		NA				
2056	152.1737	57.6700	110	Fair	3	Rect.	2.0 x 2.0	8.9 x 8.9	91 x 18	Y	36 x 18	0	0	Plastic	Degraded
							(6.5' x 6.5')	(3.50"x 3.50")	(36"x 7")		(14"x 7")				
2057	152.3383	57.6597	75	Good	3	Rect.	2.0 x 2.0	8.9 x 8.9	91 x 18	N	NA	0	0	Plastic	Degraded
							(6.5' x 6.5')	(3.50"x 3.50")	(36"x 7")		NA				
2058	152.3193	57.6925	145	Good	3	Rect.	2.1 x 2.1	8.9 x 8.9	91 x 18	N	NA	0	0	None	Intact
							(7' x 7')	(3.50"x 3.50")	(36"x 7")		NA				
2059	152.1555	57.7098	109	Fair	3	Rect.	2.0 x 2.0	8.9 x 8.9	91 x 18	Y	30 x 15	0	0	Plastic	Degraded
							(6.5' x 6.5')	(3.50"x 3.50")	(36"x 7")		(12"x 6")				
2060	152.2928	57.7117	136	Poor	3	Rect.	1.8 x 1.8	17.8 x 17.8	91 x 18	Y	61 x 30	3	2	Plastic	None
							(6' x 6')	(7.00"x 7.00")	(36"x 7")		(24"x 12")				
2061	152.3252	57.6792	140	Good	3	Pyramid	1.5 x 1.5	8.9 x 8.9	91 x 18	Y	30 x 25	0	0	Plastic	None
							(5' x 5')	(3.50"x 3.50")	(36"x 7")		(12"x 10")				
2062	152.3837	57.6348	166	Good	3	Rect.	1.8 x 1.8	10.2 x 10.2	91 x 18	N	NA	0	0	Plastic	None
							(6' x 6')	(4.00" x 4.00")	(36"x 7")		NA				
2063	152.3855	57.6460	164	Good	0	Subsit.	1.0 x 1.0 x 0.6	8.9 x 8.9	66 x 18	N	NA	0	0	Bag	None
							(40"x 40"x 24")	(3.50"x 3.50")	(26"x 7")		NA				
2064	152.3992	57.6482	78	Fair	3	Rect.	1.5 x 1.5	8.9 x 8.9	91 x 18	Y	15 x 8	0	0	Plastic	Degraded
							(5' x 5')	(3.50"x 3.50")	(36"x 7")		(6"x 3")				

(continued)

Appendix D. 3.   (Page 7 of 8)

Pot #	Longitude	Latitude	Depth (m)	Condition	Min. Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole Size cm x cm	# of Broken Sides	# of Broken Corners	Type of Bait Jar	Bio-Twine
2065	152.3903	57.6493	86	Good	3	Rect.	1.5 x 1.5	10.2 x 10.2	91 x 18	N	NA	0	1	Plastic	None
							(5' x 5')	(4.00" x 4.00")	(36"x 7")		NA				
2066	152.3845	57.6503	86	Fair	3	Shrimp	0.9 x 0.9 x 0.5	2.5 x 2.5	10	Y	25 x 15	0	3	Bag	None
							(36"x 36"x 18")	(1.00"x 1.00")	(4")		(10"x 6")				
2067	152.4105	57.6408	67	Fair	3	Conical	1.5 x 0.6	7.6 x 7.6	46	N	NA	0	0	Bag	None
							(5' x 2')	(3.00"x 3.00")	(18")		NA				
2068	152.4125	57.6333	63	Fair	3	Conical	1.2	7.6 x 7.6	46	Y	15 x 15	0	0	Plastic	Intact
							(4')	(3.00"x 3.00")	(18")		(6"x 6")				
2069	152.4077	57.6300	41	Good	3	Pyramid	1.8 x 0.6	10.2 x 10.2	46	Y	41 x 25	0	0	Plastic	Degraded
							(6' x 2')	(4.00" x 4.00")	(18")		(16"x 10")				
2070	152.4138	57.6255	37	Good	3	Rect.	2.0 x 2.0	8.9 x 8.9	91 x 18	Y	30 x 15	0	0	Plastic	None
							(6.5' x 6.5')	(3.50"x 3.50")	(36"x 7")		(12"x 6")				
2071	152.4325	57.6128	34	Poor	3	Rect.	2.0 x 1.8	17.8 x 17.8	91 x 18	Y	30 x 15	0	2	Plastic	None
							(6.5' x 6')	(7.00"x 7.00")	(36"x 7")		(12"x 6")				
2072	152.4342	57.6120	31	Good	3	Rect.	2.0 x 2.0	8.9 x 8.9	91 x 18	Y	15 x 8	0	0	Plastic	Degraded
							(6.5' x 6.5')	(3.50"x 3.50")	(36"x 7")		(6"x 3")				
2073	152.4398	57.6052	21	Fair	3	Conical	0.9 x 0.5	8.9 x 8.9	31	N	NA	0	0	Plastic	None
							(36"x 18")	(3.50"x 3.50")	(12")		NA				
2074	152.4368	57.6038	17	Good	3	ubsistence	0.9 x 0.9 x 0.5	8.9 x 8.9	76 x 18	N	NA	0	0	Plastic	None
							(36"x 3' x 18")	(3.50"x 3.50")	(30"x 7")		NA				
2075	152.4063	57.6333	57	Fair	3	Pyramid	0.9 x 0.6	8.9 x 8.9	31 x 31	N	NA	0	0	Plastic	None
							(36"x 2')	(3.50"x 3.50")	(12"x 12")		NA				
2076	152.4027	57.6467	68	Fair	3	Rect.	1.5 x 1.5	10.2 x 10.2	91 x 18	Y	NR	0	0	Plastic	Degraded
							(5' x 5')	(4.00" x 4.00")	(36"x 7")		NR				

(continued)

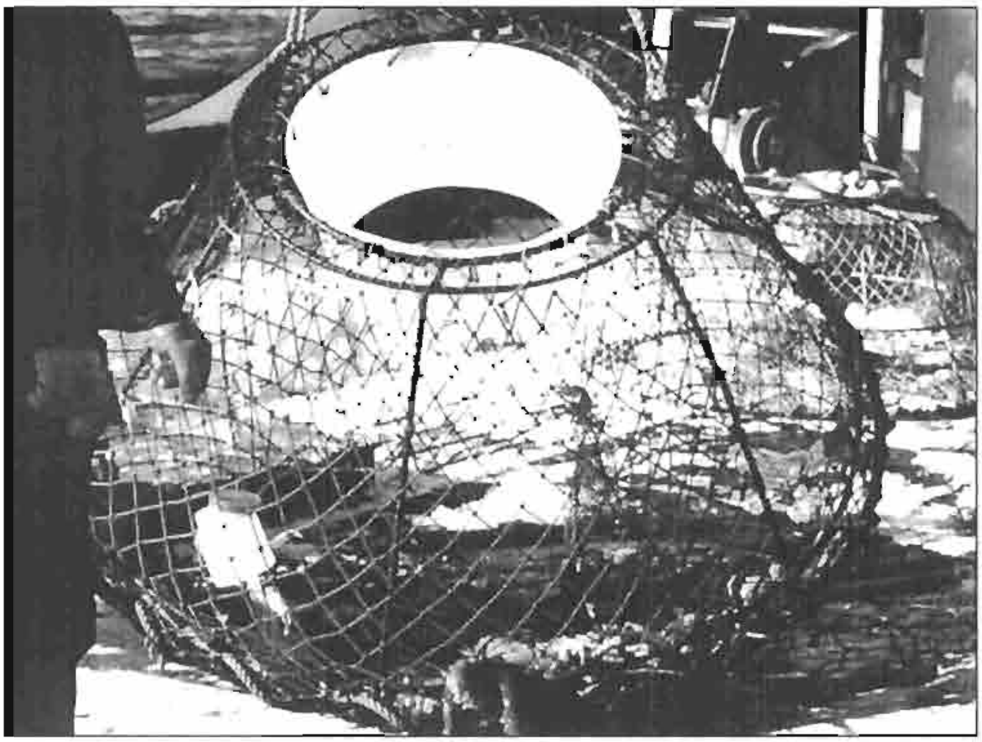
Appendix D. 3. (Page 8 of 8)

Pot #	Longitude	Latitude	Depth (m)	Condition	Min. Age (yrs)	Pot Type	Pot Dim. m x m x m	Mesh size cm x cm	Tunnel Size cm x cm	Torn Web	Largest Hole Size cm x cm	# of Broken Sides	Corners	Type of Bait Jar	Bio-Twine
2077	152.3952	57.6542	29	Good	3	Pyramid	1.2 x 0.6	8.9 x 8.9	31+J205	N	NA	0	0	Plastic	Degraded
							(4' x 2' x 12")	(3.50"x 3.50")	(12")		NA				
2078	152.3947	57.6540	29	Poor	5	Drum	0.9 x 0.6	None	8.9	N	NA	0	0	None	None
							(36"x 2')	None	(4")		NA				
2079	152.3910	57.6527	96	Fair	3	Rect.	1.5 x 1.5	10.2 x 10.2	91 x 18	Y	41 x 30	1	2	Plastic	None
							(5' x 5')	(4.00" x 4.00")	(36"x 7")		(16"x 12")				
2080	152.3542	57.6550	40	Good	5	Rect.	1.1 x 1.1 x 0.7	8.9 x 8.9	25 x 10	N	NA	0	0	Plastic	None
							(3.5' x 3.5'x 12")	(3.50"x 3.50")	(10"x 4")		NA				
2081	152.3028	57.7003	141	Good	3	Rect.	1.8 x 1.8	8.9 x 8.9	91 x 18	Y	23 x 10	0	1	Plastic	None
							(6' x 6')	(3.50"x 3.50")	(36"x 7")		(9" x 4")				
2082	152.2757	57.7190	152	Good	3	Rect.	2.0 x 2.0	8.9 x 8.9	91 x 18	N	NA	0	0	Plastic	Degraded
							(6.5' x 6.5')	(3.50"x 3.50")	(36"x 7")		NA				
2083	152.4028	57.6465	56	Good	3	Pyramid	1.2 x 0.6	8.9 x 8.9	31	N	NA	0	1	Plastic	None
							(4' x 2' x 12")	(3.50"x 3.50")	(12")		NA				
2084	152.4028	57.6355	63	Fair	3	Pyramid	1.8 x 0.6 x 0.5	10.2 x 10.2	46	Y	41 x 30	0	1	Plastic	None
							(6' x 2' x 18")	(4.00" x 4.00")	(18")		(16"x 12")				
2085	152.4043	57.7097	54	Fair	3	Round	1.2	8.9 x 8.9	25 x 10	N	NA	1	0	Plastic	None
							(4')	(3.50"x 3.50")	(10"x 4")		NA				
2086	152.4043	57.7097	54	Good	3	Round	1.2	8.9 x 8.9	25 x 10	N	NA	0	0	Plastic	None
							(4')	(3.50"x 3.50")	(10"x 4")		NA				
2087	152.4025	57.7117	59	Good	3	Round	1.2	8.9 x 8.9	25 x 10	N	NA	0	0	Plastic	None
							(4')	(3.50"x 3.50")	(10"x 4")		NA				
2088	152.4203	57.7003	31	Fair	3	Pyramid	1.8 x 0.6 x 0.3	8.9 x 8.9	31	Y	30 x 15	0	2	Plastic	None
							(6' x 2' x 12")	(3.50"x 3.50")	(12")		(12"x 6")				
2089	152.4245	57.6842	17	Good	3	Rect.	2.1 x 2.1 x 1.0	8.9 x 8.9	91 x 18	N	NA	0	0	Bag	Degraded
							(7' x 8' x 40")	(3.50"x 3.50")	(36"x 7")		NA				

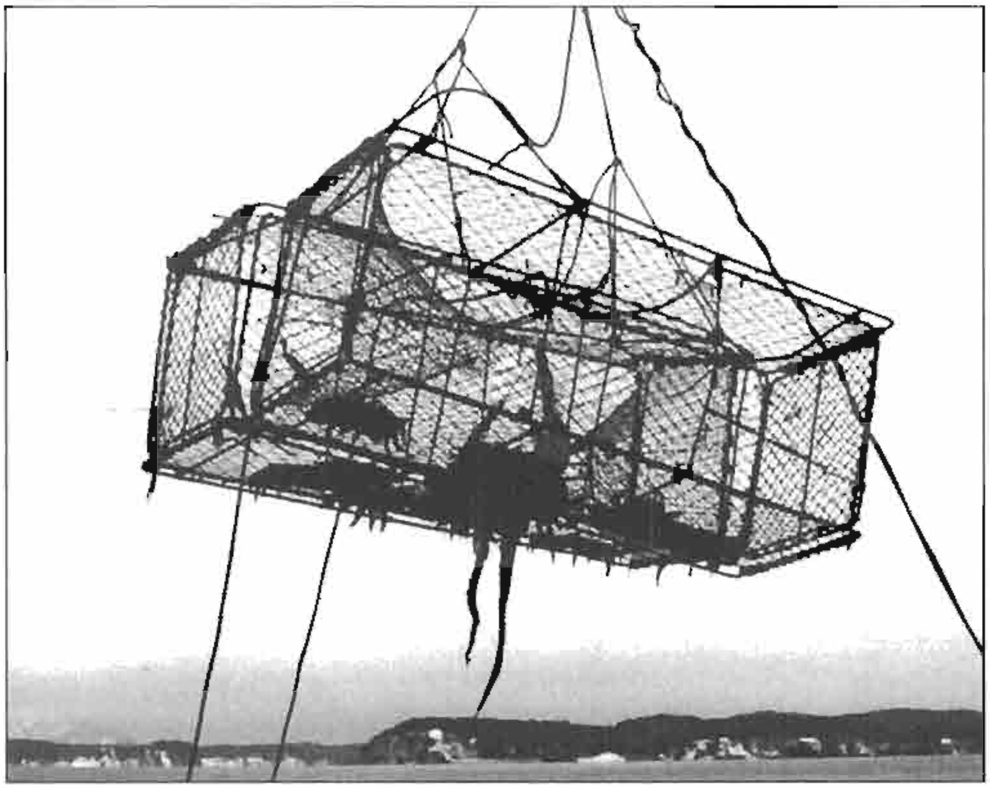
NR stands for Not Recorded. This indicates that the information did not get recorded on the data form at the time the pot was retrieved.

Appendix E. 1. A photograph of a rectangular crab pot, employed during king and Tanner crab fisheries.

Appendix E. 2. A photograph of a pyramid crab pot, employed during Tanner crab fisheries.



Appendix E. 3. A photograph of a conical crab pot, employed during Tanner crab fisheries.



Appendix E. 4. A photograph of a cod pot, employed during Pacific cod fisheries.

Appendix E. 5. A photograph of a 55 gallon drum, which had been used as a crab and/or cod and/or octopus pot, it was unclear what organism was to be caught with the pot.

Appendix F. 1. Tanner crab by sex, size, shell condition, disease, clutch condition, missing legs and other relative information on crab retrieved from pots recovered in the pilot study in 1995.

Pot #	Sex	CW (mm)	Shell Condition	Disease	Clutch Conditon	Missing Legs	Comments
112	2	155	2	0	0	0	None
112	1	129	2	0	0	0	None
112	1	138	2	0	0	0	None
112	2	151	2	0	0	0	None
112	2	163	2	0	0	0	None
112	2	148	2	0	0	0	None
112	2	141	2	0	0	0	None
112	2	145	2	0	0	0	None
112	2	151	2	0	0	0	None
112	2	140	2	0	0	0	None
112	2	141	2	0	0	0	None
112	2	143	2	0	0	0	None
112	2	145	3	0	0	0	None
112	2	155	2	0	0	0	None
112	1	134	2	0	0	0	None
112	1	135	2	0	0	0	None
112	1	138	3	0	0	0	None
112	2	148	2	0	0	0	None
112	1	137	3	0	0	0	None
112	1	127	2	0	0	0	None
112	1	138	2	0	0	0	None
112	1	108	3	0	0	0	None
143	4	94	4	0	5	0	None
145	1	127	3	0	0	0	None
145	4	98	3	0	0	0	50% Clutch Fullness

SEX CODE:
1. Sublegal Male
2. Legal Male
3.Juvenile Female
4. Adult Female

DISEASE CODE:
1. Black Mat
2. Bitter Crab Syndrome
3. Nemertean Worms
4. Parasitic Barnacle

SHELL CONDITION:
0. Soft
1. New
2. Old
3. Very Old

CLUTCH CONDITION:
0. Male or Juvenile Female
1. Dead Eggs Not Apparent
2. Dead Eggs < 20%
3. Dead Eggs > 20%
4. Barren with Clean "Silky" Setae
5. Barren with "Matted" setae, Empty Egg Cases

Appendix F. 2. Tanner crab by sex, size, shell condition, disease, clutch condition, missing legs and other relative information on crab retrieved from pots recovered in the directed study in 1996.

Pot #	Sex	CW (mm)	Shell Condition	Disease	Clutch Conditon	Missing Legs	Comments
12	1	75	1	0	0	0	None
12	4	83	1	0	1	0	80% clutch fullness
12	4	91	3	0	1	0	100% clutch fullness
18	1	62	1	0	0	0	None
18	1	67	1	0	0	0	None
18	1	67	1	0	0	0	None
18	1	93	1	0	0	0	None
18	3	63	1	0	4	0	None
18	3	72	1	0	4	0	75% clutch fullness
18	3	84	1	0	4	0	None
18	4	79	1	0	1	0	None
48	1	87	0	0	0	0	None
68	4	92	3	1	1	0	90% clutch fullness
74	2	136	3	0	0	0	None
79	1	82	1	0	0	0	None
79	1	126	1	0	0	0	None
92	1	109	1	1	0	0	None
92	4	87	2	1	1	0	95% clutch fullness
92	4	91	3	1	1	0	95% clutch fullness
92	4	92	2	1	1	0	95% clutch fullness
92	4	96	2	1	1	0	100% clutch fullness
92	4	104	3	1	1	0	95% clutch fullness
92	4	105	3	1	1	0	95% clutch fullness
92	4	105	3	1	1	0	95% clutch fullness
92	4	106	3	1	1	0	95% clutch fullness
111	1	63	1	0	0	0	None
111	3	75	1	0	0	0	None
111	4	81	1	0	0	0	None
111	4	99	1	0	0	0	None
120	3	71	1	0	0	0	None
142	3	61	1	0	4	0	None
143	1	57	1	0	0	0	None
143	1	66	1	0	0	0	None
143	1	119	1	0	0	0	Dead
143	1	138	3	0	0	0	Dead
143	3	57	1	0	0	0	None
143	3	60	1	0	0	0	None
143	3	65	1	0	0	0	None
143	3	71	1	0	0	0	None
143	4	80	1	0	0	0	None

(continued)

Appendix F. 2. (Page 2 of 2)

Pot #	Sex	CW (mm)	Shell Condition	Disease	Clutch Conditon	Missing Legs	Comments
143	4	92	3	0	1	0	100% clutch fullness
172	1	66	NR	0	0	0	None
172	1	70	NR	0	0	0	None
172	1	81	NR	0	0	0	None
172	1	85	NR	0	0	0	None
172	3	90	2	0	0	0	50% clutch fullness
172	3	91	2	0	0	0	50% clutch fullness
172	3	93	3	0	5	0	None

NR stands for Not Recorded.

SEX CODE:
1. Sublegal Male
2. Legal Male
3. Juvenile Female
4. Adult Female

DISEASE CODE:
1. Black Mat
2. Bitter Crab Syndrome
3. Nemertean Worms
4. Parasitic Barnacle

SHELL CONDITION:
0. Soft
1. New
2. Old
3. Very Old

CLUTCH CONDITION:
0. Male or Juvenile Female
1. Dead Eggs Not Apparent
2. Dead Eggs < 20%
3. Dead Eggs > 20%
4. Barren with Clean "Silky" Setae
5. Barren with "Matted" setae, Empty Egg Cases

Appendix F. 3. Tanner crab by sex, size, shell condition, disease, clutch condition, missing legs and other relative information on crab retrieved from pots recovered in the undireted study in 1996.

Pot #	Sex	CW (mm)	Shell Condition	Disease	Clutch Conditon	Missing Legs	Comments
1001	1	120	2	1	0	3	None
1001	1	120	2	1	0	1	None
1001	1	121	2	1	0	2	None
1001	1	121	1	1	0	2	None
1001	1	122	2	1	0	5	None
1001	1	122	1	1	0	7	None
1001	1	123	1	1	0	3	None
1001	1	123	1	1	0	3	None
1001	1	125	2	1	0	4	None
1001	1	125	2	1	0	3	None
1001	1	125	2	1	0	4	None
1001	1	126	1	1	0	3	None
1001	1	126	2	1	0	2	None
1001	1	126	1	1	0	0	None
1001	1	127	1	0	0	0	None
1001	1	127	2	1	0	0	None
1001	1	127	2	1	0	2	None
1001	1	127	1	1	0	3	None
1001	1	128	2	1	0	3	None
1001	1	128	2	1	0	2	None
1001	1	128	2	1	0	6	None
1001	1	128	2	1	0	1	None
1001	1	129	2	1	0	2	None
1001	1	129	1	1	0	0	None
1001	1	129	2	1	0	2	Dead
1001	1	129	2	1	0	3	None
1001	1	129	1	1	0	3	None
1001	1	130	3	1	0	2	None
1001	1	130	2	1	0	4	None
1001	1	130	2	1	0	1	None
1001	1	130	1	1	0	1	None
1001	1	130	1	1	0	1	None
1001	1	130	2	1	0	3	None
1001	1	131	2	1	0	2	None
1001	1	131	2	1	0	1	None
1001	1	131	1	1	0	5	None
1001	1	131	2	1	0	1	None
1001	1	132	2	1	0	2	None
1001	1	132	2	1	0	1	None
1001	1	132	2	1	0	3	None

(continued)

Appendix F. 3. (Page 2 of 4)

Pot #	Sex	CW (mm)	Shell Condition	Disease	Clutch Conditon	Missing Legs	Comments
1001	1	132	2	1	0	1	None
1001	1	132	2	1	0	4	None
1001	1	132	2	1	0	3	None
1001	1	133	2	1	0	3	None
1001	1	133	1	1	0	1	None
1001	1	133	2	1	0	3	None
1001	1	133	2	1	0	1	None
1001	1	134	2	1	0	4	None
1001	1	134	2	1	0	4	None
1001	1	134	2	1	0	3	None
1001	1	136	2	1	0	0	None
1001	1	136	2	1	0	0	None
1001	1	136	1	1	0	2	None
1001	1	136	1	1	0	4	None
1001	1	136	1	1	0	1	None
1001	1	136	1	1	0	2	None
1001	1	136	2	1	0	5	None
1001	1	136	2	1	0	2	None
1001	1	137	2	1	0	0	None
1001	1	137	2	1	0	0	None
1001	1	137	2	1	0	2	None
1001	1	137	1	0	0	3	None
1001	1	138	2	1	0	4	None
1001	1	138	1	0	0	1	None
1001	1	138	2	1	0	3	None
1001	1	138	2	1	0	2	Dead
1001	1	139	2	1	0	0	None
1001	1	139	1	1	0	1	None
1001	1	139	2	1	0	2	None
1001	1	139	2	1	0	3	None
1001	1	139	2	1	0	4	None
1001	1	139	1	1	0	2	None
1001	2	140	2	1	0	6	None
1001	2	140	2	1	0	3	None
1001	2	140	1	1	0	6	None
1001	2	140	2	1	0	3	None
1001	2	140	2	1	0	2	None
1001	2	141	2	1	0	4	None
1001	2	141	2	1	0	0	None
1001	2	141	2	1	0	2	None
1001	2	141	2	1	0	2	None

(continued)

Appendix F. 3. (Page 3 of 4)

Pot #	Sex	CW (mm)	Shell Condition	Disease	Clutch Conditon	Missing Legs	Comments
1001	2	142	1	1	0	2	None
1001	2	142	2	1	0	3	None
1001	2	142	2	1	0	4	None
1001	2	143	2	1	0	3	None
1001	2	143	2	1	0	2	None
1001	2	143	1	1	0	2	None
1001	2	143	2	1	0	0	None
1001	2	143	1	1	0	2	None
1001	2	143	1	1	0	1	None
1001	2	143	2	1	0	2	None
1001	2	144	2	1	0	1	None
1001	2	145	2	1	0	5	None
1001	2	146	2	1	0	5	None
1001	2	146	2	1	0	3	None
1001	2	146	2	1	0	7	None
1001	2	146	2	1	0	0	None
1001	2	147	2	1	0	2	None
1001	2	147	1	0	0	0	None
1001	2	147	2	1	0	2	None
1001	2	147	2	1	0	4	None
1001	2	147	2	1	0	3	None
1001	2	148	2	1	0	4	None
1001	2	149	2	1	0	5	Dead
1001	2	149	2	1	0	3	None
1001	2	149	1	1	0	2	None
1001	2	150	1	1	0	5	None
1001	2	151	2	1	0	2	None
1001	2	151	3	1	0	6	None
1001	2	152	2	1	0	5	None
1001	2	152	2	1	0	1	None
1001	2	155	1	1	0	3	None
1001	2	156	2	1	0	2	None
1001	2	158	2	1	0	3	None
1001	2	162	2	1	0	2	None
1001	3	68	1	1	0	1	None
1001	3	70	1	1	0	0	None
2048	1	102	1	0	0	0	None
2048	1	117	1	0	0	0	None
2048	3	68	1	0	0	0	None
2063	1	51	1	0	0	0	juvenile

(continued)

Appendix F. 3. (Page 4 of 4)

Pot #	Sex	CW (mm)	Shell Condition	Disease	Clutch Conditon	Missing Legs	Comments
2066	1	40	1	0	0	0	juvenile

NR stands for Not Recorded.

SEX CODE:
1. Sublegal Male
2. Legal Male
3.Juvenile Female
4. Adult Female

DISEASE CODE:
1. Black Mat
2. Bitter Crab Syndrome
3. Nemertean Worms
4. Parasitic Barnacle

SHELL CONDITION:
0. Soft
1. New
2. Old
3. Very Old

CLUTCH CONDITION:
0. Male or Juvenile Female
1. Dead Eggs Not Apparent
2. Dead Eggs < 20%
3. Dead Eggs > 20%
4. Barren with Clean "Silky" Setae
5. Barren with "Matted" setae, Empty Egg Cases

Appendix F. 4. Red king crab by sex, size, shell condition, disease, clutch condition, missing legs and other information on crab retrieved from pots recovered in the undirected study in 1996.

Pot #	Sex	Carapace Length (mm)	Shell Condition	Disease	Clutch Conditon	Missing Legs	Comments
2046	2	149	2	0	0	0	None
2046	2	161	2	0	0	0	None
2046	2	174	2	0	0	0	None
2063	1	52	1	0	0	0	juvenile

NR stands for Not Recorded.

SEX CODE:
1. Sublegal Male
2. Legal Male
3.Juvenile Female
4. Adult Female

DISEASE CODE:
1. Black Mat
2. Bitter Crab Syndrome
3. Nemertean Worms
4. Parasitic Barnacle

SHELL CONDITION:
0. Soft
1. New
2. Old
3. Very Old

CLUTCH CONDITION:
0. Male or Juvenile Female
1. Dead Eggs Not Apparent
2. Dead Eggs < 20%
3. Dead Eggs > 20%
4. Barren with Clean "Silky" Setae
5. Barren with "Matted" setae, Empty Egg Cases